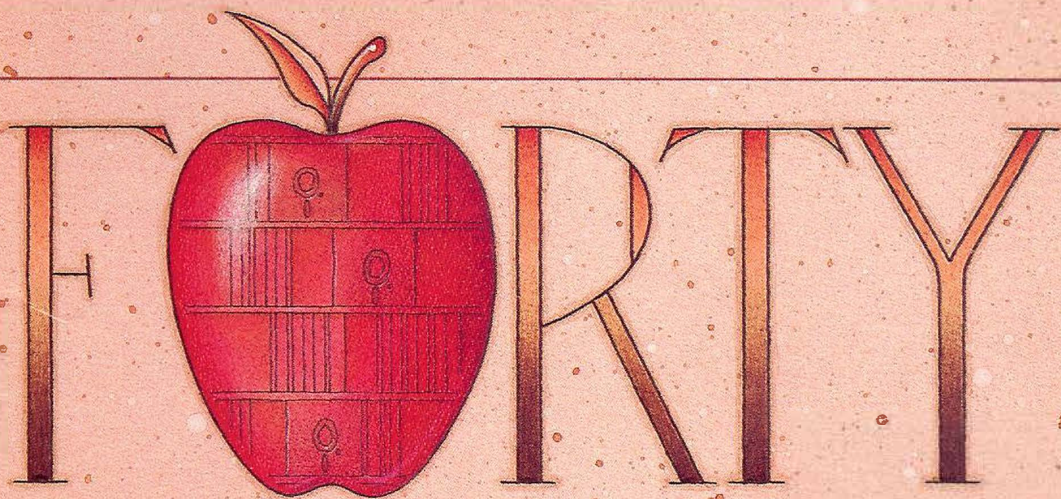


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APPLE II APPLICATIONS



Programs for Your Apple

Brian Flynn and Christopher Flynn

Forty practical, powerful applications—from educational games and personal management programs to thinking games and business tools—for the Apple II, II+, IIe, and IIfx computers.

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APPLICATIONS
40 Programs for Your Apple
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APPLE II APPLICATIONS

FORTY Programs for Your Apple

Brian Flynn and Christopher Flynn

COMPUTE! Publications, Inc. 
One of the ABC Publishing Companies
Greensboro, North Carolina

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Foreword

Apple II Applications: 40 Programs for Your Apple includes a variety of exceptional programs—enough for the entire household. From “Terrapin’s Tic-Tac-Toe” to “Simultaneous Equation Solver,” your family will love these easy-to-use games and utilities. Teach youngsters to tell time and help them study after school; make use of a small, but efficient, spreadsheet; unwind after work with thought-provoking games. You’ll see that there’s more to using a computer than just typing correspondence or zapping aliens.

Apple II Applications is a friendly introduction to the power within your computer. And as with all COMPUTE! books, *Apple II Applications* is clear and easy to understand—even if you don’t know much about computers.

The programs in *Apple II Applications* are thoroughly tested and ready to type in. “The Automatic Proofreader” makes it almost impossible to make a mistake. But if you prefer *not* to type in the programs yourself, you can order a disk with all the programs in *Apple II Applications* by calling COMPUTE! Publications toll-free 800-334-0868 (in North Carolina, call 919-275-9809). Be sure to specify whether you need the DOS 3.3 or ProDOS disk format.

CHAPTER 1

Introduction

1

Introduction

The Apple II is one of the most popular personal computers ever produced, and there are millions of Apple II owners. Just as their owners come from every walk of life, the Apple II performs a variety of applications. Used in businesses, schools, governments, and homes, the Apple II is versatile enough to handle practically any task that is suitable for a personal computer. It is this versatility that is appealing to so many people.

This book focuses on six different topics, ranging from challenging games to scientific applications. The programs have been carefully designed to be easy-to-use, practical, and entertaining. No matter what you use your Apple II for, this book will have something for you. Even if you don't think you're interested in a particular subject, try some of the programs. You might change your mind.

Equipment Required

Over the years, Apple Computer has revised and improved the Apple II. This has given rise to a series of different models all bearing the Apple II name. In the order in which they were introduced, the Apple II models are Apple II, Apple II+, Apple IIe, Apple IIC, and Enhanced Apple IIe.

Apple has been careful to maintain a high degree of compatibility between these models. That is, programs written on an older model will generally run on a newer model. Occasionally, though, some program changes may be necessary. The reverse may not be true, however. For example, a program that uses specific IIC features cannot be expected to work on an original II model.

The programs in this book will work with any of the Apple II models listed above. Your computer must have a minimum of 48K of random access memory (RAM). All models except the Apple II meet this requirement. The Apple II requires memory expansion options to bring it to 48K.

In order to see your work, you'll need a video monitor. You may use either a monochrome or color monitor. In general, monochrome (green or amber) monitors provide much clearer results than color monitors. Most of the programs in

INTRODUCTION

this book deal strictly with text and number displays, so use a monochrome monitor if you have one. The game programs give you an option of using color if you are so inclined.

You may also use a television set as your video monitor. To do so, you will need an RF modulator to connect between your computer and television. Consult the instructions that came with your computer. A decent television should provide good results since all of the programs use the Apple's 40-column display mode.

You'll need a disk drive for program and data storage, but you don't need two, although a second drive simplifies many operations. With two drives, you can keep your programs on one drive and your data on the other. Thus, you'll be able to switch rapidly between programs without having to swap disks.

Many of the programs can produce printed reports. A printer is useful for reports and listings of the programs. If you plan to change the programs, you should probably have a printer to make following the program logic easier. The programs assume that the printer interface is connected to slot 1.

Applesoft, DOS, and ProDOS

You must have Applesoft BASIC to run the programs. If you have a II+, IIe, IIc, or Enhanced IIe, you have it. For other models, you'll need a language card expansion board.

Some of the programs use short machine language programs to perform special functions. You will not need an assembler or any knowledge of machine language. In the cases where machine language routines are used, they are POKEd into memory by the Applesoft program.

The operating system handles communications between Applesoft and the disk drive. There are two Apple operating systems that will work with Applesoft. The original operating system is called the Disk Operating System, or, more simply, DOS; it has been available for many years and has been upgraded several times. The last official version is DOS 3.3. Apple eventually developed a totally new operating system—Professional Disk Operating System (ProDOS), which is a replacement for DOS and contains many features not available in DOS. In keeping with Apple's tradition, ProDOS retains a high degree of compatibility with DOS—at least from the Applesoft programmer's point of view.

Not all of the programs in this book work with disk data

INTRODUCTION

files. Those that do will work with either DOS 3.3 or ProDos. You won't have to make any program changes to accommodate the operating system. *The only exception is the "Menu" program in Appendix A, which is strictly a ProDOS program and will not work with DOS 3.3.*

Typing In the Programs

Typing the programs and getting them running can be instructive. Each program is modular in design and will generally consist of three parts: a definition of variables, a main routine, and a series of subroutines.

Once you get used to the modular design, you will begin to understand the internal structure of the programs. Armed with this knowledge, you should be able to modify any of the programs to suit your specific needs.

To make program entry less prone to errors, use "Apple Automatic Proofreader" by Tim Victor (inspired by Charles Brannon's original), which checks each line for accuracy as you type it in. *Read Appendix B before attempting to type in any of the programs in the book.* Be sure to save a copy of Automatic Proofreader; it will be used for future applications in COMPUTE! books and in other COMPUTE! publications.

If you have problems with a program, you may wonder if there is a bug in the program or a typographical error in the listing. Each program has been tested by several people, and while this doesn't guarantee that the programs are perfect, the program listings were produced directly from working copies on disks rather than typeset by hand. If problems persist, use Automatic Proofreader and double-check your typing. See Appendix B for the Automatic Proofreader listing.

General Operating Instructions

The chapters describe the specific operating instructions for each program and provide examples of how the programs should work. Read the instructions before running a program. Most programs will display brief instructions when they are running as reminders to help you along.

Several programs ask you to type in data or supply a response. Some of these programs use a special input subroutine, which highlights in inverse video the screen area where you can type your response. The input subroutine allows you to edit your response before you press Return. Three

edit keys are active: Control-X for erase response, Control-C for stop the program, and left arrow for backspace. These keys, which are associated with the special input subroutine, are available when you are asked to type in a response into a field that is highlighted by inverse video.

Special ProDOS Warning

The main directory on a ProDOS disk is known as the volume directory. ProDOS allows only 51 entries in the volume directory regardless of how much space on the disk is unused. You must establish subdirectories on the disk if you plan to have more than 51 files, including programs.

For example, suppose you have 50 programs on the disk and all are entered in the volume directory. You can catalog only one more file in the volume directory. If a program creates two data files, you may have problems.

You can establish subdirectories from either a BASIC program or with the ProDOS *System Utilities* disk. The programs in this book are not designed to create subdirectories, so if you need subdirectories, establish them beforehand.

The programs that ask you for a filename will accept a complete ProDOS path name. For example, you may type
/MYDISK/DATA/GROCERY.LIST

as a filename. The above path name tells ProDOS that the disk itself is labeled MYDISK, that DATA is a subdirectory name, and that GROCERY.LIST is the data file name. Consult your ProDOS manual for a more complete discussion of path names.



CHAPTER 2

Games of Skill

1111

2

Games of Skill

In some of these games ("Enigma," "Memory Mate," "Knights Errant," "Pharaoh's Pyramid," and "Elementary, Watson") you'll play against yourself. The Apple will present a puzzle, contest, or riddle, and you'll have to achieve a goal in as few moves as possible. In other games ("Terrapin's Tic-Tac-Toe," "Roman Checkers," and "Falstaff") you compete with the computer, and the Apple is a formidable opponent. Finally, in two of the games ("Witching Hour" and "Fox and Geese") you'll play against another person.

No matter which type of game you play, however, all have one common thread. Each challenges your intellect, memory, concentration, and persistence. What you accomplish is up to you rather than luck.

Enigma. The Apple scrambles a secret phrase chosen randomly from its library of 75 entries. Your job is to decipher the message as quickly as possible.

Elementary, Watson. The Apple creates a hidden code consisting of four items chosen from these six: a duck, a bell, a pipe, a violin, a vial, and an apple. Employing your high powers of logic, you must deduce the code in short order.

Knights Errant. A dozen Don Quixotes face a legion of harmless windmills. Try to transfer each group of pieces from one side of the board to the other in as few moves as possible.

Pharaoh's Pyramid. On the Giza plateau, ten miles west of the city of Cairo, Egypt, stands the Great Pyramid of Cheops. The Apple draws the Pyramid using 14 blocks. Try to remove as many blocks as possible; a piece is lifted from play when it's jumped.

Terrapin's Tic-Tac-Toe. Play against the Apple in this version of an old favorite. Kids and grownups will love the animation.

Roman Checkers. Try to line up five of your chariots in a row on an 8×8 board before the Apple lines up five of its markers.

Falstaff. You're pitted against the Apple in this version of what's been called one of the most entertaining games of

logic ever invented. Place one of your markers on an empty square so that a string of the Apple's pieces is capped at both ends; then watch as the Apple's markers turn into yours.

Memory Mate. The Apple will draw from three to eight objects on your screen, covering each one as it goes. Try to recall where each object is and the order in which the Apple drew it.

Witching Hour. In this two-player *fright* to the finish, 12 wicked witches oppose 12 crafty cats.

Fox and Geese. An intriguing two-player game of wits from the Middle Ages. Play begins with 17 geese and one fox poised for combat on a cross-shaped board. The geese try to surround the fox, and the fox tries to gobble up the geese.

ENIGMA

In this exciting game of cryptography, the Apple selects a message from its lexicon of 75 famous phrases. Then it garbles the message by interchanging a letter in the expression with a random selection from the alphabet. *GOOSE* might end up *KMMGD*, for example.

Your goal is to decipher the scrambled message in less than 25 moves by centering the cursor over a letter in the garbled code (use the left and right arrows) and entering what you think is the correct character.

Figure 2-1 illustrates the setup. The top bar in each group holds the cryptogram, the middle space your entries, and the bottom bar the correct letters that you've identified.

A good place to begin deciphering this message is with the double-letter sequence *ZZ*. Two *N*'s or *S*'s or *T*'s are possibilities here, and on the third try we find that *T* is correct.

Next, the two-letter word *BZ* is ripe for solution. Since the *Z* is a *T*, the *B* must be either an *A* or an *I*, giving us *AT* or *IT*. As it turns out, *A* is correct.

Now we're somewhat at a loss. Since *E* is the most popular letter in the English language, however, and since four *H*'s and three *Q*'s appear in the garbled message, perhaps the *E* is one of these. We try the *Q* and, as luck would have it, the *H* is actually the *E*.

Where do we go from here? Well, the second letter in the first word is likely to be a consonant since it's surrounded by *E*'s. Trial and error reveals an *N*.

We proceed in this fashion through the rest of the code, using common sense guesses based on our knowledge of the English language. We eventually come up with this translation:
ENEMY ATTACK-NE ROUTE, AT DAWN

GAMES OF SKILL

Figure 2-1. Enigma

HQHJO BZZBLX-QH GAVZH, BZ PBFQ	
T	23 guesses remain
TT - T , T	
HQHJO BZZBLX-QH GAVZH, BZ PBFQ	
T A	21 guesses remain
ATTA - T , AT A	
HQHJO BZZBLX-QH GAVZH, BZ PBFQ	
E T A	19 guesses remain
EE ATTA - E TE, AT A	

Program 2-1. Enigma

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

F9 100 REM ENIGMA
A6 110 REM INITIALIZE
45 120 GOSUB 240
89 130 REM SELECT PHRASE
54 140 GOSUB 580
5F 150 REM PLAY GAME
55 160 GOSUB 850
EE 170 REM PLAY AGAIN
5F 180 VTAB 22: HTAB 11: PRINT "PLAY AGAIN (Y/N) ? "
      ;:CLICK = PEEK {Z}
64 190 GET S$
83 200 IF S$ = "Y" THEN 140
0F 210 IF S$ < > "N" THEN 180
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
AD 240 REM INITIALIZE
4F 250 : REM TITLE
4D 260 GOSUB 330
06 270 : REM INSTRUCTIONS
58 280 GOSUB 380

```

GAMES OF SKILL

```
20 290 : REM MAX # GUESSES; # OF PHRASES
CE 300 MX = 25:NP = 75
92 310 BELL$ = CHR$ (7):Z = - 16336: DIM ALBT(26)
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$ (21): TEXT : HOME
BF 350 VTAB 12: HTAB 17: PRINT "ENIGMA"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
21 370 RETURN
8D 380 REM INSTRUCTIONS
58 390 HOME
98 400 PRINT "DEPARTMENT G2 HAS INTERCEPTED A ";: IN
    VERSE : PRINT "SECRET": NORMAL
87 410 PRINT "ENEMY MESSAGE."
E7 420 PRINT
94 430 PRINT "YOUR GOAL IS TO DECODE IT BY"
EB 440 PRINT
CE 450 PRINT " -- CENTERING THE CURSOR OVER A LETTER
    "
11 460 PRINT TAB( 5)"IN THE GARBLED MESSAGE (USE THE
    "
C2 470 PRINT TAB( 5)"LEFT & RIGHT ARROWS)."
F3 480 PRINT
C3 490 PRINT " -- ENTERING WHAT YOU THINK IS THE"
05 500 PRINT TAB( 5)"CORRECT CHARACTER."
E6 510 PRINT
E7 520 PRINT "PLEASE SET YOUR ";: INVERSE : PRINT "C
    APS LOCK";: NORMAL : PRINT " KEY TO"
8A 530 PRINT "UPPER CASE."
87 540 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY"
E5 550 R = RND (1): IF PEEK ( - 16384) < = 127 THEN
    550
1C 560 POKE - 16368,0
23 570 RETURN
97 580 REM SELECT PHRASE
5A 590 HOME
19 600 PRINT "WOULD YOU LIKE ME TO SELECT THE"
BB 610 VTAB 2: HTAB 1: PRINT "MESSAGE (Y/N) ? ";:BELL
    $;
5B 620 GET S$
0F 630 IF S$ < > "Y" AND S$ < > "N" THEN 610
F7 640 IF S$ = "Y" THEN GOSUB 670
B3 650 IF S$ = "N" THEN GOSUB 750
22 660 RETURN
B5 670 REM COMPUTER SELECTS
D3 680 RESTORE
FD 690 C = INT ( RND (1) * NP) + 1
73 700 FOR I = 1 TO C
84 710 READ PH$
03 720 NEXT
```

GAMES OF SKILL

```
C3 730 L = LEN (PH$)
1F 740 RETURN
19 750 REM PLAYER SELECTS
56 760 HOME
2B 770 PRINT "PLEASE ENTER YOUR MESSAGE. UP TO 35"
5D 780 PRINT "CHARACTERS ARE ALLOWED."
87 790 VTAB 5: HTAB 12: PRINT SPC( 60):CLICK = PEEK
    (Z)
8E 800 VTAB 5: HTAB 1: INPUT "PHRASE = ? ";PH$
C0 810 L = LEN (PH$)
7B 820 IF L < 3 THEN VTAB 23: HTAB 11: PRINT "THAT'S
    TOO EASY ! ": GOTO 790
EA 830 IF L > 35 THEN VTAB 23: HTAB 11: PRINT "THAT'
    S TOO LONG ! ": GOTO 790
20 840 RETURN
8F 850 REM GAME
8B 860 REM DRAW BOX
D6 870 GOSUB 1010
2F 880 REM LABEL
E0 890 GOSUB 1120
CC 900 REM RECORD PUNCTUATION
E5 910 GOSUB 1170
FA 920 REM SCRAMBLE PHRASE
E7 930 GOSUB 1260
A2 940 REM PLAY
F1 950 GOSUB 1560
A3 960 REM DISPLAY OUTCOME
F2 970 GOSUB 2360
38 980 IF GUESS$ = PH$ THEN GOSUB 2420
7B 990 IF GUESS$ < > PH$ THEN GOSUB 2450
D1 1000 RETURN
9B 1010 REM BOX
0F 1020 HOME : INVERSE
A6 1030 VTAB 1: HTAB 1: PRINT SPC( 39)
AB 1040 VTAB 2: HTAB 1: PRINT SPC( 39)
B0 1050 VTAB 3: HTAB 1: PRINT SPC( 39)
4B 1060 VTAB 24: HTAB 1: PRINT SPC( 39);
E5 1070 FOR ROW = 4 TO 23
C7 1080 VTAB ROW: HTAB 1: PRINT SPC( 1): HTAB 39: PR
    INT SPC( 1)
C5 1090 NEXT
3B 1100 NORMAL
D7 1110 RETURN
E9 1120 REM LABEL
DA 1130 VTAB 2: HTAB 16: PRINT " ENIGMA "
9B 1140 VTAB 7: HTAB 10: PRINT "GUESSES REMAINING: "
    ;: INVERSE : PRINT MX: NORMAL
B2 1150 VTAB 13: HTAB 3: PRINT "MESSAGE:"
EB 1160 RETURN
81 1170 REM PUNCTUATION
```


GAMES OF SKILL

```

63 1180 GUESS$ = ""
41 1190 FOR I = 1 TO L
37 1200 L$ = MID$ (PH$,I,1):A = ASC (L$)
50 1210 IF (A > 64 AND A < 91) THEN L$ = CHR$ (32)
95 1220 GUESS$ = GUESS$ + L$
B1 1230 NEXT
C5 1240 INVERSE : VTAB 17: HTAB 3: PRINT GUESS$: NOR
    MAL
E9 1250 RETURN
D0 1260 REM SCRAMBLE
08 1270 FOR I = 1 TO 26:ALBT(I) = 0: NEXT
E1 1280 VTAB 22: HTAB 15: FLASH : PRINT "SCRAMBLING"
    : NORMAL
3C 1290 SC$ = GUESS$
21 1300 FOR I = 1 TO L
98 1310 L$ = MID$ (PH$,I,1):S$ = MID$ (SC$,I,1):R$ =
    L$
53 1320 IF ASC (L$) = 32 OR ASC (S$) < > 32 THEN 137
    0
DC 1330 REM GET RANDOM LETTER
59 1340 GOSUB 1410
D3 1350 REM SUBSTITUTE R$ FOR ALL OCCURRENCES OF L$
91 1360 GOSUB 1470
8D 1370 NEXT I
AF 1380 REM DISPLAY
1A 1390 INVERSE : VTAB 15: HTAB 3: PRINT SC$: NORMAL
D9 1400 RETURN
19 1410 REM RANDOM LETTER
65 1420 CLICK = PEEK (Z)
26 1430 V = 1 + INT (26 * RND (1)): IF ALBT(V) = 1 T
    HEN 1430
F9 1440 R$ = CHR$ (64 + V):ALBT(V) = 1
71 1450 CLICK = PEEK (Z)
F1 1460 RETURN
F0 1470 REM SUBSTITUTE
F3 1480 FOR J = I TO L
2F 1490 IF MID$ (PH$,J,1) < > L$ THEN 1540
83 1500 LT$ = "":RT$ = ""
7C 1510 IF J < > 1 THEN LT$ = LEFT$ (SC$,J - 1)
47 1520 IF J < > L THEN RT$ = MID$ (SC$,J + 1)
C9 1530 SC$ = LT$ + R$ + RT$
86 1540 NEXT J
EF 1550 RETURN
F6 1560 REM PLAY
6F 1570 N = 0:COL = 3
78 1580 REM ENTER LETTER
7D 1590 GOSUB 1710
27 1600 REM CHECK FOR MATCH
C9 1610 R$ = "RIGHT": IF MID$ (PH$,P,1) < > C$ THEN
    R$ = "WRONG":N = N + 1

```

GAMES OF SKILL

```

8E 1620 REM DISPLAY RESULT
F7 1630 VTAB 22: HTAB 13: PRINT R$;" LETTER !";:CLIC
    K = PEEK (Z)
B1 1640 FOR PAUSE = 1 TO 500: NEXT PAUSE
7A 1650 IF R$ = "WRONG" THEN VTAB 7: HTAB 29: PRINT
    SPC( 2);: HTAB 29: INVERSE : PRINT MX - N: N
    ORMAL
C8 1660 IF R$ = "RIGHT" THEN GOSUB 1860
4C 1670 REM ENTER GUESS
EC 1680 IF GUESS$ < > PH$ THEN GOSUB 1980
36 1690 IF GUESS$ < > PH$ AND N < MX THEN 1580
DF 1700 RETURN
3E 1710 REM GET LETTER
BF 1720 VTAB 22: HTAB 13: PRINT "MOVE AND PICK"
54 1730 VTAB 16: HTAB COL:P = COL - 2
72 1740 GET S$
CF 1750 A = ASC (S$)
46 1760 IF A = 8 OR A = 21 THEN GOSUB 1800: GOTO 173
    0
B6 1770 IF (A < 65 OR A > 90) OR MID$ (GUESS$,P,1) <
    > CHR$ (32) THEN PRINT BELL$;: GOTO 1740
62 1780 C$ = CHR$ (A): PRINT C$;
04 1790 RETURN
54 1800 REM NEW CURSOR POSITION
98 1810 IF A = 8 AND P = 1 THEN COL = L + 2
5E 1820 IF A = 8 AND P < > 1 THEN COL = COL - 1
FB 1830 IF A = 21 AND P = L THEN COL = 3
2C 1840 IF A = 21 AND P < > L THEN COL = COL + 1
F5 1850 RETURN
B4 1860 REM HIT
C7 1870 FOR J = 1 TO L
B3 1880 IF MID$ (PH$,J,1) = C$ THEN GOSUB 1910
A0 1890 NEXT J
E3 1900 RETURN
E2 1910 REM SUBSTITUTE
93 1920 LT$ = "":RT$ = ""
D8 1930 IF J < > 1 THEN LT$ = LEFT$ (GUESS$,J - 1)
9C 1940 IF J < > L THEN RT$ = MID$ (GUESS$,J + 1)
75 1950 GUESS$ = LT$ + C$ + RT$
DB 1960 INVERSE : VTAB 17: HTAB 3: PRINT GUESS$: NOR
    MAL
FF 1970 RETURN
1A 1980 REM GUESS
88 1990 VTAB 22: HTAB 8: PRINT "GUESS THE MESSAGE (Y
    /N) ? ";:CLICK = PEEK (Z)
55 2000 GET S$
62 2010 IF S$ < > "Y" AND S$ < > "N" THEN 1990
77 2020 IF S$ = "Y" THEN GOSUB 2050: GOSUB 2260
21 2030 VTAB 22: HTAB 8: PRINT SPC( 25)
E2 2040 RETURN

```

GAMES OF SKILL

```
FC 2050 REM GUESS
96 2060 G$ = "":C = 3
31 2070 VTAB 22: HTAB 8: PRINT SPC( 25)
16 2080 VTAB 19: HTAB 3: PRINT "GUESS:"
98 2090 INVERSE : VTAB 20: HTAB 3: PRINT SPC( L);BEL
    L$
D1 2100 REM LINE INPUT
99 2110 VTAB 20: HTAB C
DB 2120 GET L$
A0 2130 A = ASC (L$)
BF 2140 IF (C = 3 AND A = 8) OR (C = L + 3 AND A < >
    8 AND A < > 13) THEN PRINT BELL$: GOTO 2110
88 2150 IF A = 8 THEN GOSUB 2200
7D 2160 IF A < > 8 AND A < > 13 THEN PRINT L$;:G$ =
    G$ + L$:C = C + 1
80 2170 IF A < > 13 THEN 2110
5C 2180 NORMAL
FB 2190 RETURN
88 2200 REM MOVE CURSOR LEFTWARD
47 2210 IF LEN (G$) = 1 THEN G$ = ""
24 2220 IF LEN (G$) > 1 THEN G$ = LEFT$ (G$, LEN (G$
    ) - 1)
D9 2230 C = C - 1
1A 2240 PRINT CHR$ (8); SPC( 1)
EA 2250 RETURN
2B 2260 REM EVALUATE ANSWER
36 2270 AN$ = "WRONG !"
F3 2280 IF G$ = PH$ THEN AN$ = "RIGHT !":GUESS$ = G$
DC 2290 VTAB 19: HTAB 3: PRINT SPC( 6)
7F 2300 VTAB 22: HTAB 17: FLASH : PRINT AN$: NORMAL
CD 2310 FOR PAUSE = 1 TO 20: PRINT BELL$;: NEXT PAUS
    E
6E 2320 VTAB 22: HTAB 13: PRINT "PRESS ANY KEY";
67 2330 GET S$
B0 2340 VTAB 20: HTAB 3: PRINT SPC( 36)
EC 2350 RETURN
5E 2360 REM OUTCOME
83 2370 M$ = "SO SORRY ... SIGH."
EA 2380 IF GUESS$ = PH$ THEN M$ = "CONGRATULATIONS !
    "
3F 2390 VTAB 22: HTAB 8: PRINT SPC( 25)
DB 2400 VTAB 19: HTAB 11: PRINT M$
DE 2410 RETURN
AF 2420 REM WINNER
CA 2430 INVERSE : VTAB 17: HTAB 3: PRINT PH$: NORMAL
EA 2440 RETURN
5D 2450 REM LOSER
DD 2460 VTAB 21: HTAB 3: PRINT "VIEW THE MESSAGE (Y/
    N) ? ";BELL$;
79 2470 GET S$
```

GAMES OF SKILL

```
DD 2480 IF S$ < > "Y" AND S$ < > "N" THEN 2460
B4 2490 VTAB 21: HTAB 3: PRINT SPC( 24)
01 2500 IF S$ = "Y" THEN GOSUB 2420
E0 2510 RETURN
A3 2520 REM MESSAGES
0C 2530 DATA GOD SAVE THE QUEEN
5A 2540 DATA "THE FEW, THE PROUD, THE MARINES!"
9B 2550 DATA A FEW GOOD MEN
67 2560 DATA "I CAME, I SAW, I CONQUERED"
E2 2570 DATA I SHALL NOT DEAL IN MALICE
F4 2580 DATA LOVE THY NEIGHBOR
EB 2590 DATA TAKE IT EASY
13 2600 DATA EVERY WHICH WAY BUT LOOSE
23 2610 DATA THE RUSSIANS ARE COMING
2B 2620 DATA JACK AND JILL WENT UP A HILL
36 2630 DATA THE COW JUMPED OVER THE MOON
B5 2640 DATA HEY DIDDLE DIDDLE
74 2650 DATA THE OLD GRAY MARE
7D 2660 DATA "TINKER, TAILOR, SOLDIER, SPY"
A3 2670 DATA THE GRAPES OF WRATH
2B 2680 DATA GONE WITH THE WIND
0A 2690 DATA THE GULAG ARCHIPELAGO
9F 2700 DATA TIE ME KANGAROO DOWN MATE
73 2710 DATA MY LITTLE CHICKADEE
75 2720 DATA THE LAST OF THE MOHICANS
14 2730 DATA NICE GUYS FINISH LAST
7A 2740 DATA THE WHOLE NINE YARDS
29 2750 DATA I LOVE NEW YORK
25 2760 DATA DON QUIXOTE AND SANCHO PANZA
6A 2770 DATA HONEST ABE LINCOLN
CE 2780 DATA "EAST SIDE, WEST SIDE"
04 2790 DATA SUGAR AND SPICE AND EVERYTHING NICE
A4 2800 DATA OF MICE AND MEN
F2 2810 DATA ALICE IN WONDERLAND
B9 2820 DATA THERE'S SOMETHING ROTTEN IN DENMARK
24 2830 DATA WHAT A REVOLTING PREDICAMENT
21 2840 DATA A ROLLING STONE GATHERS NO MOSS
A7 2850 DATA BEAM ME ABOARD SCOTTY
9C 2860 DATA IT'S A LONG WAY TO TIPPERARY
96 2870 DATA THE ANSWER IS BLOWING IN THE WIND
D4 2880 DATA GIVE ME LIBERTY OR GIVE ME DEATH
BE 2890 DATA DIVIDE AND CONQUER
7B 2900 DATA IT'S THE REAL THING
B5 2910 DATA I THINK THEREFORE I AM
56 2920 DATA A STITCH IN TIME SAVES NINE
D5 2930 DATA THERE'S NO FREE LUNCH
3E 2940 DATA TWAS THE NIGHT BEFORE CHRISTMAS
EE 2950 DATA "RED SKY AT NIGHT, SAILORS DELIGHT"
F2 2960 DATA IN THE LONG RUN WE'RE ALL DEAD
7B 2970 DATA "HAIL TO THE REDSKINS, HAIL VICTORY"
```

GAMES OF SKILL

21 2980 DATA "TO ERR IS HUMAN, TO FORGIVE DIVINE"
1D 2990 DATA THE MOUSE RAN UP THE CLOCK
C7 3000 DATA A CAT HAS NINE LIVES
EA 3010 DATA THE JOLLY GREEN GIANT
23 3020 DATA BEAUTIFUL DOWNTOWN BURBANK
C4 3030 DATA ELEMENTARY MY DEAR WATSON
91 3040 DATA MARY HAD A LITTLE LAMB
2E 3050 DATA HE WHO HESITATES IS LOST
CF 3060 DATA COLUMBIA THE GEM OF THE OCEAN
F8 3070 DATA THIS LAND IS MADE FOR YOU AND ME
5F 3080 DATA "MOBY DICK, THE GREAT WHITE WHALE"
2D 3090 DATA THE HOUND OF THE BASKERVILLES
3B 3100 DATA THE BRONX BOMBER
6C 3110 DATA I AM THE GREATEST
74 3120 DATA SLOW AS MOLASSES
44 3130 DATA THE LAND OF THE RISING SUN
10 3140 DATA "ALMOST HEAVEN, WEST VIRGINIA"
80 3150 DATA FROM THE HALLS OF MONTEZUMA
65 3160 DATA TOO MANY COOKS SPOIL THE BROTH
A5 3170 DATA "HARK THE RAVEN, NEVERMORE !"
40 3180 DATA TOM SAWYER AND HUCKLEBERRY FINN
98 3190 DATA WHERE'S THE BEEF ?
84 3200 DATA TWINKLE TWINKLE LITTLE STAR
99 3210 DATA IT'S A GRAND SLAM HOME RUN
95 3220 DATA E PLURIBUS UNUM
5E 3230 DATA NO TAXATION WITHOUT REPRESENTATION
9B 3240 DATA I WISH I WAS IN THE LAND OF COTTON
94 3250 DATA E EQUALS MC SQUARED
88 3260 DATA THE HUNCHBACK OF NOTRE DAME
3C 3270 DATA AND THEY LIVED HAPPILY EVER AFTER

ELEMENTARY, WATSON

Imagine that you are Watson sitting by the fire. Suddenly the door flies open and Holmes appears, drenching wet. "The game's afoot, Watson!" he cries. "This note holds the key to the Farmingdale frame-up."

You leap to your feet and protest that you see only a blank piece of paper in his hand. He replies, "That, my dear Watson, is precisely what makes the game interesting."

The secret code in this game of logic consists of a column of four items chosen randomly from these six: a duck, a bell, a pipe, a violin, a vial, and an apple. An item might appear more than once or not at all. The code remains invisible while you play, and your goal is to figure it out based on clues that your Apple provides.

















Play begins with the computer asking you to select an item for each of the four positions in the column. For example, you could guess a duck, a vial, a bell, and a pipe, in that order (Figure 2-2).

The Apple grades your guess by using two kinds of markers, one solid and one hollow. The number of solid markers indicates how many objects are of the right kind and in the right location. The number of hollow markers indicates how many objects are of the right kind but in the wrong location.

Each item in the secret code receives one marker at most. You'll therefore never see more than four circles in your score. Four solid markers indicate victory, and four hollow ones mean that you've identified all the right objects, but none of them is in the right place. A complete absence of markers, on the other hand, means that none of the objects you've selected is in the hidden code. This is often fortunate because it eliminates a number of objects from further consideration.

GAMES OF SKILL

Figure 2-2. Elementary, Watson

Secret Code		Guesses			
		1	2	3	4
(Violin)	<div>1</div>				
(Duck)	<div>2</div>				
(Vial)	<div>3</div>				
(Pipe)	<div>4</div>				
	S c o r e	<div>●</div> <div>○</div> <div>○</div>	<div>●</div>	<div>●</div> <div>●</div> <div>○</div> <div>○</div>	<div>●</div> <div>●</div> <div>●</div> <div>●</div>

Program 2-2. Elementary, Watson

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

EE 100 LOMEM: 17000
67 110 REM ELEMENTARY, WATSON
A8 120 REM INITIALIZE
45 130 GOSUB 230
50 140 REM PLAY GAME
CB 150 GOSUB 1200
EC 160 REM PLAY AGAIN
8F 170 VTBAT 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
      ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
6D 210 TEXT : HOME : PRINT "ELEMENTARY, MY DEAR WATS
      ON."
```

GAMES OF SKILL

```
8E 220 END
AB 230 REM INITIALIZE
2B 240 REM TITLE
4F 250 GOSUB 350
8B 260 REM INSTRUCTIONS
4C 270 GOSUB 410
5B 280 REM VALUES
55 290 GOSUB 530
F6 300 REM SHAPES
5B 310 GOSUB 580
51 320 REM DIFFICULTY
CB 330 GOSUB 1110
1B 340 RETURN
2E 350 REM TITLE
31 360 PRINT CHR$(21): TEXT : HOME
E5 370 VTAB 12: HTAB 11: PRINT "ELEMENTARY, WATSON"
01 380 FOR PAUSE = 1 TO 2000: NEXT
9C 390 BELL$ = CHR$(7)
14 400 RETURN
8B 410 REM INSTRUCTIONS
4B 420 HOME
39 430 HTAB 8: PRINT "THE GAME'S AFOOT WATSON!";BELL
    $: PRINT
56 440 PRINT "AND OUR JOB IS TO GUESS THE APPLE'S"
E4 450 PRINT "SECRET CODE USING THESE MARKERS:"
F9 460 VTAB 7: HTAB 3: INVERSE : PRINT "SOLID";: NOR
    MAL : PRINT " RIGHT ITEM IN THE RIGHT SPOT"
87 470 VTAB 9: HTAB 2: INVERSE : PRINT "HOLLOW";: NO
    RMAL : PRINT " RIGHT ITEM IN THE WRONG SPOT"
6C 480 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
FE 490 R = RND (1): IF PEEK ( - 16384) < 128 THEN 49
    0
10 500 POKE - 16384,0
4F 510 HOME : VTAB 12: HTAB 17: PRINT "READING"
19 520 RETURN
51 530 REM VALUES
65 540 DATA DUCK,VIOLIN,BELL,VIAL,APPLE,PIPE
76 550 FOR I = 1 TO 6: READ ITEM$(I): NEXT
EA 560 Z = - 16336: REM CLICK
23 570 RETURN
09 580 REM SHAPES
9B 590 REM DIRECTORY
95 600 DATA 15,0,32,0,97,0,147,0,211,0,0,1,109,1,134
    ,1,185,1,223,1,242,1,255,1,8,2,20,2,28,2,40,2
01 610 REM DUCK
E1 620 DATA 1,32,37,37,36,37,45,21,46,61,63,46,63,39
    ,54,61,62,62,46,37
3C 630 DATA 46,62,63,46,45,55,55,22,55,39,36,37,39,6
    2,62,22,62,60,36,44
9B 640 DATA 61,39,55,36,55,39,39,45,44,53,37,44,37,5
    9,55,39,23,55,60,36
```

GAMES OF SKILL

39 650 DATA 59,50,46,54,0
 35 660 REM VIOLIN
 57 670 DATA 41,53,55,39,55,62,52,55,47,53,55,61,54,5
 9,63,44,44,61,63,55
 2E 680 DATA 60,44,37,31,44,40,38,44,46,38,37,47,44,3
 8,37,39,37,45,62,46
 0B 690 DATA 41,28,12,12,12,12,12,44,54,0
 82 700 REM BELL
 0C 710 DATA 45,45,45,45,50,30,31,50,39,60,54,22,51,5
 9,39,35,36,44,38,37
 C1 720 DATA 45,44,36,45,28,63,62,36,63,36,39,39,63,6
 0,62,28,22,54,53,53
 1F 730 DATA 45,46,54,46,37,45,39,36,55,62,38,36,36,3
 9,39,63,55,53,37,46
 CE 740 DATA 62,45,54,0
 88 750 REM VIAL
 D3 760 DATA 36,36,36,36,53,54,54,54,54,53,53,53,46,6
 2,62,62,39,44,39,36
 0F 770 DATA 55,54,54,39,23,39,39,39,37,45,54,37,36,6
 3,47,44,45,60,47,36
 46 780 DATA 36,36,36,36,0
 FA 790 REM APPLE
 B3 800 DATA 36,36,37,36,37,53,18,53,45,53,53,46,54,5
 4,39,36,60,60,60,55
 5A 810 DATA 46,54,54,14,37,53,62,62,60,54,61,55,36,3
 6,36,36,39,36,60,54
 12 820 DATA 54,46,54,54,54,62,36,36,36,55,54,54,39,3
 6,36,44,36,36,60,28
 6D 830 DATA 54,54,54,54,54,54,62,36,36,36,36,36,36,6
 0,54,54,54,54,54
 7E 840 DATA 38,39,36,36,36,36,36,55,54,54,54,54,6
 0,36,36,36,36,62
 C2 850 DATA 54,54,54,54,36,39,36,36,0
 0B 860 REM PIPE
 CD 870 DATA 10,9,9,46,45,52,62,63,46,45,30,63,39,55,
 39,39,39,39,39,39
 FE 880 DATA 39,39,63,63,0
 4C 890 REM SQUARE
 C6 900 DATA 39,45,54,63,39,36,45,45,54,54,63,63,39,3
 6,36,45,45,45,54,54
 76 910 DATA 54,63,63,63,39,36,36,36,45,45,45,45,54,5
 4,54,54,63,63,63
 D1 920 DATA 46,45,45,45,36,36,36,36,36,0
 13 930 REM SOLID CIRCLE
 8B 940 DATA 36,36,45,46,46,54,54,39,36,39,60,54,46,5
 4,46,30,39,36,55,54
 A9 950 DATA 39,36,36,36,60,54,54,54,54,60,36,36,36,2
 3,54,54,6,0
 79 960 REM HOLLOW CIRCLE

GAMES OF SKILL

```
EF 970 DATA 18,18,63,28,28,36,36,12,12,45,45,21,14,5
    4,54,30,30,63,0
98 980 REM LETTERS: S,c,o,r,e,d
C0 990 DATA 39,35,12,45,21,30,42,50,30,63,28,6,0
AD 1000 DATA 40,61,63,23,54,14,45,37,0
46 1010 DATA 40,21,54,30,63,7,32,36,41,5,6,0
0A 1020 DATA 35,41,61,63,51,54,46,0
91 1030 DATA 40,21,62,63,39,12,23,54,14,45,37,0
6B 1040 DATA 56,23,54,14,45,37,36,60,37,60,0
5F 1050 FOR I = 16384 TO 16946
03 1060 READ V
D2 1070 POKE I,V
C1 1080 NEXT
EC 1090 POKE 233,64: POKE 232,0
D3 1100 RETURN
4C 1110 REM DIFFICULTY
42 1120 HOME
0C 1130 PRINT "WOULD YOU LIKE THE ";: INVERSE : PRIN
    T "1";: NORMAL : PRINT "EASY OR ";: INVERSE
    : PRINT "2";: NORMAL : PRINT "HARD"
FA 1140 VTB 2: HTAB 1: PRINT "VERSION ? ";BELL$;
6A 1150 GET S$
5E 1160 V = VAL (S$)
4B 1170 IF V < 1 OR V > 2 THEN 1140
FF 1180 K = V + 4: REM # OF ITEMS
F7 1190 RETURN
5E 1200 REM PLAY GAME
57 1210 REM INITIAL POSITION
53 1220 GOSUB 1320
3D 1230 REM ENTER MOVE
87 1240 GOSUB 1660
87 1250 REM GRADE MOVE
AB 1260 GOSUB 1980
CE 1270 REM CHECK FOR END
4D 1280 IF RR < > 4 AND N > 0 THEN 1240
A2 1290 REM DISPLAY RESULT
77 1300 GOSUB 2180
DB 1310 RETURN
5D 1320 REM INITIAL POSITION
9F 1330 REM RECORD
51 1340 GOSUB 1400
1A 1350 REM VERTICAL LABEL
89 1360 GOSUB 1460
15 1370 REM HORIZONTAL LABEL
AD 1380 GOSUB 1590
FB 1390 RETURN
95 1400 REM RECORD
A5 1410 FOR I = 1 TO 4
79 1420 SCODE(I) = INT (K * RND (1)) + 1
B5 1430 NEXT
```


GAMES OF SKILL

```
EE 1440 N = 10: REM TURNS LEFT
ED 1450 RETURN
FF 1460 REM LABEL
B6 1470 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= 3
16 1480 FOR Y = 10 TO 85 STEP 25
BD 1490 DRAW 7 AT 10,Y
AB 1500 NEXT
BA 1510 HCOLOR= 0
7C 1520 DRAW 11 AT 10,10: DRAW 12 AT 10,35: DRAW 15
    AT 10,60: DRAW 14 AT 10,85
DA 1530 HCOLOR= 3
C3 1540 Y = 113
64 1550 FOR I = 10 TO 14
6E 1560 DRAW I AT 10,Y:Y = Y + 10
C7 1570 NEXT
FB 1580 RETURN
0E 1590 REM LABEL
99 1600 VTAB 22: HTAB 1
89 1610 FOR I = 1 TO 5
B5 1620 INVERSE : PRINT I;: NORMAL : PRINT ITEM$(I);
    SPC( 2);
89 1630 NEXT
DE 1640 IF K = 6 THEN VTAB 24: HTAB 1: INVERSE : PRI
    NT "6";: NORMAL : PRINT ITEM$(6);
F1 1650 RETURN
51 1660 REM ENTER MOVE
62 1670 REM DISPLAY TURNS LEFT
77 1680 GOSUB 1800
18 1690 REM GUESS
7C 1700 VTAB 24: HTAB 11: PRINT "PLEASE ENTER ITEM";
AB 1710 FOR I = 1 TO 4
A9 1720 GOSUB 1890
2E 1730 ITEM = A - 48
4D 1740 IF ITEM < 1 OR ITEM > K THEN PRINT BELL$;: G
    OTO 1720
21 1750 DRAW ITEM AT XC,I * 25 - 15
AB 1760 GUESS(I) = ITEM
95 1770 NEXT I
6A 1780 N = N - 1
04 1790 RETURN
26 1800 REM TURNS LEFT
74 1810 VTAB 24: HTAB 11: PRINT SPC( 18);
57 1820 S$ = STR$(N) + " TURNS LEFT"
DB 1830 IF N = 1 THEN S$ = "YOUR LAST CHANCE !"
A1 1840 VTAB 24: HTAB (21 - LEN (S$) / 2): PRINT S$;
6E 1850 FOR I = 1 TO 20:CLICK = PEEK (Z): FOR PAUSE
    = 1 TO 150: NEXT PAUSE,I
9A 1860 VTAB 24: HTAB 12: PRINT SPC( 18)
42 1870 XC = (10 - N) * 25 + 35: REM X COORDINATE
02 1880 RETURN
```

GAMES OF SKILL

```
71 1890 REM FLASH & GET
1D 1900 DRAW 7 AT XC,I * 25 - 15
04 1910 FOR PAUSE = 1 TO 10:P = PEEK ( - 16384): NEX
    T PAUSE
62 1920 XDRAW 7 AT XC,I * 25 - 15
0C 1930 FOR PAUSE = 1 TO 10:P = PEEK ( - 16384): NEX
    T PAUSE
05 1940 IF P < 128 THEN 1900
E0 1950 POKE - 16368,0
5E 1960 A = P - 128
FF 1970 RETURN
D1 1980 REM GRADE MOVE
D2 1990 FOR I = 1 TO 4:CODE(I) = SCODE(I): NEXT
F3 2000 Y = 113:RR = 0
E6 2010 REM RIGHT ITEM, RIGHT PLACE (RR)
76 2020 GOSUB 2080
E4 2030 REM RIGHT ITEM, WRONG PLACE
AA 2040 FOR I = 1 TO 4
CD 2050 IF GUESS(I) < > - 9 THEN GOSUB 2130
84 2060 NEXT I
EE 2070 RETURN
CB 2080 REM RIGHT ITEM, RIGHT PLACE
BE 2090 FOR I = 1 TO 4
1C 2100 IF CODE(I) = GUESS(I) THEN DRAW 8 AT XC,Y:Y
    = Y + 12:GUESS(I) = - 9:CODE(I) = - 9:RR = R
    R + 1
A0 2110 NEXT
DC 2120 RETURN
E6 2130 REM RIGHT ITEM, WRONG PLACE
2D 2140 FOR J = 1 TO 4
6D 2150 IF CODE(J) = GUESS(I) THEN DRAW 9 AT XC,Y:Y
    = Y + 12:CODE(J) = - 9:J = 4
87 2160 NEXT J
F0 2170 RETURN
62 2180 REM OUTCOME
97 2190 VTAB 22: HTAB 1: PRINT SPC( 40)
35 2200 VTAB 24: HTAB 1: PRINT SPC( 39);
70 2210 FLASH : VTAB 24: HTAB 13: PRINT "THE GAME'S
    OVER";: NORMAL
A3 2220 FOR PAUSE = 1 TO 15: PRINT BELL$;: NEXT
43 2230 VTAB 24: HTAB 13: PRINT SPC( 15);
6E 2240 REM VICTORY OR DEFEAT
67 2250 IF RR = 4 THEN GOSUB 2280
29 2260 IF RR < > 4 THEN GOSUB 2360
F2 2270 RETURN
D0 2280 REM VICTORY
0A 2290 G = 10 - N: REM NUMBER OF GUESSES
04 2300 RK$ = " AMATEUR"
37 2310 IF G > 5 AND G < 8 THEN RK$ = " SCOTLAND YAR
    DER"
```

GAMES OF SKILL

```
BB 2320 IF G < = 5 THEN RK$ = " HOLMES, THE MASTER "
    "
FB 2330 S$ = "RANK:"
3C 2340 VTAB 22: HTAB 21 - LEN (S$ + RK$) / 2: INVER
    SE : PRINT S$;: NORMAL : PRINT RK$
EC 2350 RETURN
FB 2360 REM DEFEAT
AB 2370 VTAB 22: HTAB 8: PRINT "VIEW THE SECRET (Y/N
    ) = ? ";BELL$;
7B 2380 GET S$
9A 2390 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N"
    AND S$ < > "n" THEN 2370
9D 2400 IF S$ = "Y" OR S$ = "y" THEN GOSUB 2420
DE 2410 RETURN
C3 2420 REM SECRET
8A 2430 Y = 10
B2 2440 FOR I = 1 TO 4
C9 2450 HCOLOR= 0: DRAW 7 AT 10,Y: HCOLOR= 3
B6 2460 DRAW SCODE(I) AT 10,Y
40 2470 Y = Y + 25
CA 2480 NEXT
FE 2490 RETURN
```

KNIGHTS ERRANT

A dozen Don Quixotes face a legion of harmless windmills in this solitaire game of logic. Your goal is to transfer each group of pieces from one side of the board to the other in as few moves as possible (see Figure 2-3). Each piece moves as a knight moves in chess: one square forward or backward and two sideways, or two squares forward or backward and one sideways.

To move a piece, simply enter its identifying letter (*a* to *y*). You'll see the amazing spectacle of either Don Quixote galloping or the windmill rotating. Completing the game in less than 43 moves is genius-level play, worthy of our chivalrous Man from La Mancha.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-3A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-3B. You don't have to run Program 2-3A again.

Program 2-3A. Knights Errant Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
C0 100 REM SHAPE DATA FOR KNIGHTS ERRANT
7C 110 REM DIRECTORY
7F 120 DATA 31,0,64,0,205,0,101,1,254,1,85,2,161,2,2
    05,2,216,2,227,2,236,2,247,2,3,3,13,3,26,3,37
    ,3,46,3,55,3,68,3,77,3,89,3,99,3,111,3,123,3,
    134,3,142,3,153,3,164,3,174,3,183,3,195,3,208
    ,3
6C 130 REM HORSE #1
5C 140 DATA 36,36,36,36,37,36,13,30,46,53,45,58,63,6
    0,62,63,46,45,45,45
79 150 DATA 45,58,63,63,63,63,39,23,46,45,45,45,45,4
    5,45,58,63,63,63,63
EF 160 DATA 63,63,55,45,45,45,45,45,45,53,53,54,3
    9,60,60,63,63,63,63
42 170 DATA 63,63,63,46,45,45,45,45,45,45,53,53,46,3
    0,39,60,60,63,63,63
D6 180 DATA 63,63,63,55,45,45,45,45,45,53,53,63,3
    2,63,55,46,46,54,53
```

GAMES OF SKILL

- 25 190 DATA 54, 53, 62, 60, 62, 36, 37, 39, 37, 39, 60, 39, 60, 63, 63, 63, 55, 45, 45, 45
- 5A 200 DATA 53, 63, 63, 55, 54, 54, 54, 39, 36, 36, 36, 55, 54, 54, 54, 39, 36, 36, 36, 0
- 79 210 REM HORSE #2
- 10 220 DATA 36, 36, 36, 44, 60, 36, 37, 63, 55, 47, 53, 63, 46, 53, 63, 46, 53, 63, 55, 45
- 71 230 DATA 49, 63, 59, 52, 63, 63, 47, 45, 45, 46, 45, 45, 37, 36, 54, 45, 37, 37, 53, 53
- 69 240 DATA 45, 45, 45, 45, 52, 61, 62, 27, 27, 27, 54, 39, 60, 62, 36, 55, 63, 51, 41, 53
- 0F 250 DATA 63, 63, 39, 63, 63, 23, 63, 63, 23, 63, 39, 39, 55, 10, 41, 45, 45, 45, 45, 45
- 7B 260 DATA 40, 46, 45, 45, 45, 58, 63, 63, 63, 59, 63, 63, 63, 63, 47, 46, 45, 45, 45, 45
- 53 270 DATA 13, 45, 45, 45, 62, 63, 63, 31, 59, 63, 63, 63, 63, 46, 45, 45, 45, 45, 45
- C9 280 DATA 45, 45, 50, 53, 23, 30, 30, 4, 8, 60, 39, 37, 63, 60, 63, 62, 63, 63, 60, 55
- 75 290 DATA 63, 46, 53, 14, 21, 31, 58, 32, 35, 55, 6, 0
- 88 300 REM HORSE #3
- F6 310 DATA 39, 44, 60, 44, 39, 39, 44, 60, 36, 37, 63, 54, 54, 62, 36, 36, 52, 55, 54, 53
- A2 320 DATA 46, 55, 55, 55, 63, 63, 45, 45, 46, 46, 36, 47, 37, 37, 54, 62, 46, 62, 45, 45
- E2 330 DATA 44, 36, 36, 37, 37, 53, 53, 46, 12, 45, 45, 45, 52, 61, 38, 63, 63, 63, 23, 54
- AD 340 DATA 60, 39, 39, 55, 46, 54, 53, 54, 53, 45, 46, 38, 39, 63, 63, 54, 45, 53, 46, 46
- 86 350 DATA 39, 39, 63, 63, 36, 36, 37, 60, 36, 54, 55, 61, 54, 54, 39, 36, 60, 63, 53, 53
- 88 360 DATA 47, 54, 55, 63, 63, 39, 63, 55, 62, 58, 23, 23, 62, 28, 44, 44, 44, 5, 32, 60
- DA 370 DATA 60, 63, 62, 38, 37, 37, 45, 45, 44, 44, 45, 46, 53, 53, 54, 61, 39, 60, 60, 39
- FB 380 DATA 55, 55, 63, 46, 54, 37, 44, 45, 53, 60, 60, 39, 0
- 77 390 REM WINDMILL #1
- 65 400 DATA 1, 32, 44, 13, 45, 53, 37, 36, 60, 54, 39, 55, 39, 23, 63, 60, 36, 37, 36, 37
- AA 410 DATA 63, 63, 46, 53, 55, 53, 55, 58, 58, 39, 63, 39, 55, 54, 46, 36, 53, 37, 53, 13
- 44 420 DATA 14, 61, 62, 62, 46, 62, 55, 53, 55, 54, 54, 54, 62, 63, 44, 37, 63, 12, 37, 39
- DA 430 DATA 37, 44, 45, 45, 45, 37, 36, 39, 36, 21, 46, 50, 54, 53, 55, 45, 62, 55, 45, 46
- 81 440 DATA 54, 63, 39, 44, 46, 5, 0
- F0 450 REM WINDMILL #2
- 8C 460 DATA 36, 37, 45, 46, 46, 54, 53, 38, 37, 37, 61, 39, 55, 60, 60, 60, 39, 44, 44, 44
- 45 470 DATA 37, 45, 39, 39, 39, 54, 55, 61, 62, 62, 62, 63, 39, 39, 39, 60, 36, 62, 62, 62

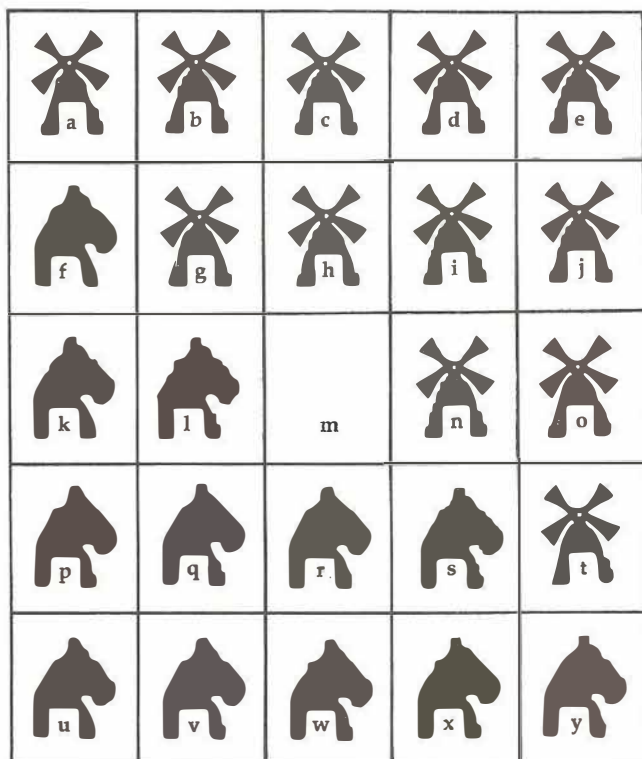
GAMES OF SKILL

```

92 480 DATA 45,53,47,53,53,53,62,55,55,63,62,47,46,4
    6,38,36,53,36,37,37
D1 490 DATA 45,52,53,47,54,55,54,55,45,45,60,39,37,3
    9,37,0
68 500 REM WINDMILL #3
5F 510 DATA 8,32,45,41,45,46,36,36,55,62,60,62,60,58
    ,39,39,44,36,44,60
AE 520 DATA 63,55,45,62,46,62,22,53,54,63,56,35,55,3
    9,55,62,36,36,53,45
9A 530 DATA 53,45,5,0
0E 540 REM LETTERS
4F 550 DATA 3,40,45,50,54,63,63,32,41,45,0
C0 560 DATA 40,21,54,30,63,39,36,44,39,36,0
11 570 DATA 40,61,63,23,54,14,45,37,0
E9 580 DATA 56,23,54,14,45,37,36,60,37,60,0
01 590 DATA 40,21,62,63,39,12,23,54,14,45,37,0
05 600 DATA 37,8,28,63,50,62,53,54,5,0
39 610 DATA 40,21,54,54,59,39,9,56,63,32,12,5,0
D2 620 DATA 40,21,54,62,27,35,36,44,39,44,0
94 630 DATA 60,12,48,50,54,62,45,4,0
0F 640 DATA 32,8,22,54,54,30,63,32,0
AD 650 DATA 8,49,51,51,41,58,27,35,44,39,36,44,0
B7 660 DATA 36,60,53,54,54,46,63,7,0
2D 670 DATA 12,53,54,62,3,32,36,59,54,54,5,0
81 680 DATA 40,21,54,62,27,35,36,44,5,0
60 690 DATA 40,21,54,30,63,7,32,36,41,5,6,0
AB 700 DATA 40,21,54,59,63,36,44,55,54,54,6,0
38 710 DATA 40,53,54,54,36,63,63,32,12,5,0
34 720 DATA 40,61,63,51,61,54,54,0
A0 730 DATA 40,61,63,23,14,45,21,30,63,63,0
CA 740 DATA 40,63,36,54,47,54,54,41,5,32,0
73 750 DATA 24,51,54,14,45,33,47,36,36,0
15 760 DATA 8,49,54,51,35,35,35,36,0
0F 770 DATA 9,52,54,62,7,32,54,59,36,36,4,0
03 780 DATA 33,57,58,35,51,41,50,41,34,59,59,42,0
A1 790 DATA 9,52,54,54,59,39,40,61,63,32,36,0
AD 800 FOR I = 16384 TO 17371
A6 810 READ V
0E 820 POKE I,V
06 830 NEXT
53 840 PRINT CHR$(4);"BSAVE KE.SHAPE,A16384,L988"
9A 850 END

```

Figure 2-3. Knights Errant



Program 2-3B. Knights Errant

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

C6 100 REM KNIGHTS ERRANT
A6 110 REM INITIALIZE
41 120 GOSUB 220
5B 130 REM PLAY GAME
4F 140 GOSUB 840
EA 150 REM PLAY AGAIN
8D 160 VTAB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
60 170 GET S$
E1 180 IF S$ = "Y" OR S$ = "y" THEN 140
FF 190 IF S$ < > "N" AND S$ < > "n" THEN 160
E0 200 TEXT : HOME : PRINT "BYE-BYE"
9C 210 END
    
```

GAMES OF SKILL

```
A9 220 REM INITIALIZE
29 230 REM TITLE
47 240 GOSUB 320
86 250 REM INSTRUCTIONS
57 260 GOSUB 380
56 270 REM VALUES
57 280 GOSUB 550
08 290 REM SHAPES
50 300 GOSUB 780
15 310 RETURN
28 320 REM TITLE
28 330 PRINT CHR$(21): TEXT : HOME
28 340 VTAB 12: HTAB 13: PRINT "KNIGHTS ERRANT"
FA 350 FOR PAUSE = 1 TO 2000: NEXT
96 360 BELL$ = CHR$(7)
21 370 RETURN
80 380 REM INSTRUCTIONS
58 390 HOME
08 400 PRINT "A DOZEN DON QUIXOTES FACE A LEGION OF"
09 410 PRINT "HARMLESS WINDMILLS, THOUGHT TO BE"
DC 420 PRINT "'LAWLESS GIANTS.'": PRINT
E6 430 PRINT "YOUR GOAL IS TO TRANSFER EACH GROUP"
C6 440 PRINT "FROM ONE SIDE OF THE BOARD TO THE OTHE
    R"
EB 450 PRINT "IN AS FEW MOVES AS POSSIBLE.": PRINT
13 460 PRINT "EACH PIECE MOVES AS IN CHESS: ONE"
01 470 PRINT "SQUARE FORWARD AND TWO SIDeways, OR"
C2 480 PRINT "VICE VERSA."
6D 490 VTAB 13: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
56 500 GET S$
01 510 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 490
1F 520 K1 = 3:K2 = 3
0E 530 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
1D 540 RETURN
55 550 REM VALUES
38 560 : REM BOARD
A2 570 DIM R$(9,9)
FA 580 FOR I = 1 TO 9: FOR J = 1 TO 9
AD 590 R$(I,J) = "OFF"
A3 600 NEXT J,I
26 610 : REM MOVES
6C 620 DATA -2,1,-2,-1,-1,2,-1,-2,2,1,2,-1,1,2,1,-2
4A 630 N = 8
D2 640 FOR I = 1 TO N
8D 650 READ DX(I),DY(I)
9A 660 NEXT
D6 670 : REM ROW & COL OF EACH LETTER
8C 680 DEF FN ROW(V) = INT ((V - 1) / 5) + 3
```

GAMES OF SKILL

```
80 690 DEF FN COL(V) = V - 5 * INT ((V - 1) / 5) + 2
D0 700 : REM X & Y COORDINATES
67 710 DEF FN X(I) = 43 * I - 77
C1 720 DEF FN Y(I) = 31 * I - 76
90 730 : REM OUTCOMES
88 740 DATA GENIUS !, MASTER, JOURNEYMAN, APPRENTICE
    , NOVICE, TURKEY
1C 750 FOR I = 1 TO 6: READ RK$(I): NEXT
EC 760 Z = - 16336: REM CLICK
25 770 RETURN
08 780 REM SHAPES
5C 790 HOME
67 800 VTAB 12: HTAB 15: PRINT "READING ..."
73 810 PRINT CHR$(4); "BLOAD KE.SHAPE"
97 820 POKE 233,64: POKE 232,0
1E 830 RETURN
64 840 REM PLAY GAME
E0 850 REM INITIAL POSITION
61 860 GOSUB 970
D3 870 REM ENTER MOVE
FE 880 GOSUB 1390
23 890 REM MAKE MOVE
F1 900 GOSUB 1680
89 910 REM CHECK FOR END
D6 920 GOSUB 2030
EA 930 IF GAME$ = "ON" THEN 880
D7 940 REM OUTCOME
D6 950 GOSUB 2110
25 960 RETURN
E5 970 REM INITIAL POSITION
07 980 REM RECORD
EF 990 GOSUB 1060
08 1000 REM DRAW GRILL
5B 1010 GOSUB 1150
58 1020 REM DRAW PIECES
7F 1030 GOSUB 1280
EF 1040 VTAB 24: HTAB 1: INVERSE : PRINT "MOVES";: N
    ORMAL
E5 1050 RETURN
A5 1060 REM RECORD
E9 1070 FOR I = 3 TO 7
6E 1080 FOR J = 3 TO 7
73 1090 R$(I,J) = "K"
07 1100 IF (I = 3) OR (I = 4 AND J > 3) OR (I = 5 AN
    D J > 5) OR (I = 6 AND J = 7) THEN R$(I,J) =
    "W"
F2 1110 NEXT J,I
57 1120 R$(5,5) = ""
EA 1130 MOVES = 0
E3 1140 RETURN
```

GAMES OF SKILL

```
AE 1150 REM GRILL
9A 1160 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= K1
17 1170 : REM HORIZONTAL LINES
36 1180 FOR I = 1 TO 156 STEP 31
1E 1190 FOR J = 0 TO 2
CE 1200 HPLLOT 30,I + J TO 247,I + J
F4 1210 NEXT J,I
0D 1220 : REM VERTICAL LINES
32 1230 FOR I = 30 TO 245 STEP 43
0C 1240 FOR J = 0 TO 2
72 1250 HPLLOT I + J,1 TO I + J,158
09 1260 NEXT J,I
F1 1270 RETURN
11 1280 REM PIECES
36 1290 LT = 7
01 1300 : REM KNIGHT = 1; WINDMILL = 4
07 1310 FOR I = 3 TO 7
5C 1320 FOR J = 3 TO 7
36 1330 X = FN X(J);Y = FN Y(I)
A7 1340 S = 1: IF R$(I,J) = "W" THEN S = 4
05 1350 IF R$(I,J) < > "" THEN HCOLOR= K2: DRAW S AT
    X,Y: HCOLOR= 3: DRAW LT AT X,Y + 9
A9 1360 LT = LT + 1
0F 1370 NEXT J,I
F7 1380 RETURN
57 1390 REM ENTER MOVE
06 1400 : REM SELECT PIECE
77 1410 GOSUB 1460
06 1420 : REM CHECK LEGALITY
8B 1430 GOSUB 1570
0A 1440 IF M$ = "NAUGHTY" THEN GOSUB 1640: GOTO 1410
ED 1450 RETURN
DD 1460 REM ENTER
B0 1470 VTAB 22: HTAB 16: PRINT SPC( 9)
A9 1480 VTAB 22: HTAB 17: INVERSE : PRINT "SELECT";:
    NORMAL : PRINT CHR$( 32);:CLICK = PEEK (Z)
00 1490 GET S$
43 1500 A = ASC (S$): IF A > 96 THEN A = A - 32
0F 1510 LT = A - 64
F4 1520 IF LT < 1 OR LT > 25 THEN 1480
F0 1530 R1 = FN ROW(LT):C1 = FN COL(LT)
C0 1540 IF R$(R1,C1) = "" THEN 1480
62 1550 INVERSE : PRINT CHR$( A): NORMAL
F3 1560 RETURN
59 1570 REM CHECK LEGALITY
0E 1580 M$ = "NAUGHTY"
69 1590 FOR I = 1 TO N
02 1600 R2 = R1 + DX(I):C2 = C1 + DY(I)
3E 1610 IF R$(R2,C2) = "" THEN M$ = "OKAY":I = N
B5 1620 NEXT
```


GAMES OF SKILL

```
E9 1630 RETURN
E4 1640 REM ILLEGAL MOVE
31 1650 FLASH : VTAB 22: HTAB 16: PRINT M$: NORMAL
CC 1660 FOR PAUSE = 1 TO 400:CLICK = PEEK (Z): NEXT
F9 1670 RETURN
EF 1680 REM MAKE MOVE
2C 1690 S = 1:S(1) = 2:S(2) = 3
2B 1700 IF R$(R1,C1) = "W" THEN S = 4:S(1) = 5:S(2)
    = 6
E5 1710 : REM FROM
95 1720 GOSUB 1770
66 1730 IF R$(R1,C1) = "W" THEN GOSUB 1890
4C 1740 : REM TO
91 1750 GOSUB 1940
F7 1760 RETURN
09 1770 REM FLASH FIGURE
65 1780 CNT = 1
DB 1790 X = FN X(C1):Y = FN Y(R1)
EC 1800 IF R$(R1,C1) = "K" THEN GOSUB 1890: REM ERAS
    E KNIGHT
9D 1810 FOR I = 1 TO 3
98 1820 SHAPE = S(CNT)
56 1830 HCOLOR= K2: DRAW SHAPE AT X,Y
BB 1840 FOR PAUSE = 1 TO 150: NEXT PAUSE
95 1850 HCOLOR= 0: DRAW SHAPE AT X,Y
8F 1860 CNT = 3 - CNT
97 1870 NEXT I
02 1880 RETURN
00 1890 REM ERASE FIGURE
BE 1900 HCOLOR= 0
EB 1910 DRAW S AT X,Y
BB 1920 DRAW 6 + LT AT X,Y + 9
EF 1930 RETURN
BE 1940 REM NEW SQUARE
F4 1950 X = FN X(C2):Y = FN Y(R2)
1C 1960 HCOLOR= K2: DRAW S AT X,Y
F7 1970 HCOLOR= 3:L = 5 * (R2 - 3) + (C2 - 2): DRAW
    6 + L AT X,Y + 9
9F 1980 : REM RECORD CHANGE
AB 1990 MOVES = MOVES + 1
FD 2000 VTAB 24: HTAB 7: PRINT MOVES;
09 2010 R$(R2,C2) = R$(R1,C1):R$(R1,C1) = ""
DA 2020 RETURN
BB 2030 REM CHECK FOR END
CC 2040 GAME$ = "OVER"
E2 2050 FOR I = 3 TO 7
67 2060 FOR J = 3 TO 7
30 2070 IF ((I = 3) OR (I = 4 AND J > 3) OR (I = 5 A
    ND J > 5) OR (I = 6 AND J = 7)) AND R$(I,J)
    = "W" THEN GAME$ = "ON":J = 7:I = 7
```

GAMES OF SKILL

```
0E 2080 NEXT J,I
1A 2090 IF R$(5,5) < > "" THEN GAME$ = "ON"
04 2100 RETURN
46 2110 REM OUTCOME
90 2120 VTAB 22: HTAB 17: PRINT SPC( 8)
52 2130 FLASH : VTAB 22: HTAB 13: PRINT "THE GAME'S
      OVER": NORMAL
9F 2140 FOR PAUSE = 1 TO 10: PRINT BELL$;: NEXT
F4 2150 S$ = "RANK:"
96 2160 V = INT (MOVES / 10) - 2
57 2170 IF MOVES > 89 THEN V = 6
0A 2180 IF MOVES < 43 THEN V = 1
EE 2190 RK$ = CHR$ (32) + RK$(V)
44 2200 VTAB 22: HTAB 13: PRINT SPC( 15)
2E 2210 VTAB 22: HTAB 21 - LEN (S$ + RK$) / 2: INVER
      SE : PRINT S$;: NORMAL : PRINT RK$
0E 2220 RETURN
```

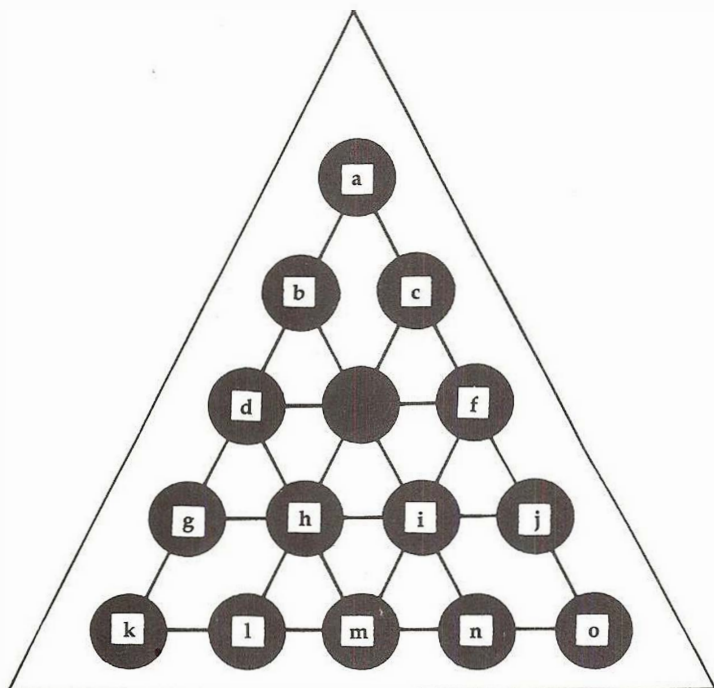
PHARAOH'S PYRAMID

On the Giza plateau, ten miles west of Cairo, Egypt, stands the Great Pyramid of Cheops. The Apple reproduces the ancient wonder on your video screen in this solitaire game of skill (Figure 2-4).

Your goal is to remove as many of the 14 square markers as possible. A piece is lifted from play when it's jumped. To play the game, first choose one of the 14 positions to make it blank. Then start to move by jumping.

You're crowned the new pharaoh if you wind up with one piece left at the end of the game. You win a sphinx if two pieces remain. But three or four left means back to the quarry. And five or more means you've just been entombed.

Figure 2-4. Pharaoh's Pyramid



GAMES OF SKILL

Program 2-4. Pharaoh's Pyramid

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
6B 100 LOMEM: 16650
13 110 REM PHARAOH'S PYRAMID
AB 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
E9 150 GOSUB 1180
EC 160 REM PLAY AGAIN
8F 170 VTAB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
2B 240 REM TITLE
4F 250 GOSUB 350
88 260 REM INSTRUCTIONS
4C 270 GOSUB 410
58 280 REM VALUES
5D 290 GOSUB 570
F6 300 REM SHAPES
48 310 GOSUB 730
51 320 REM MATRIX OF LEGAL MOVES
C5 330 GOSUB 1000
1B 340 RETURN
2E 350 REM TITLE
31 360 PRINT CHR$ (21): TEXT : HOME
EB 370 VTAB 12: HTAB 11: PRINT "PHARAOH'S PYRAMID"
01 380 FOR PAUSE = 1 TO 2000: NEXT
9C 390 BELL$ = CHR$ (7)
14 400 RETURN
88 410 REM INSTRUCTIONS
4B 420 HOME
3B 430 PRINT "ON THE GIZA PLATEAU, TEN MILES WEST OF
    "
9C 440 PRINT "THE CITY OF CAIRO, EGYPT, STANDS THE"
BB 450 PRINT "GREAT PYRAMID OF CHEOPS.": PRINT
1C 460 PRINT "I'M ABOUT TO FILL THIS ANCIENT WONDER"
B7 470 PRINT "WITH 14 BLOCKS.": PRINT
8A 480 PRINT "TRY TO REMOVE AS MANY AS POSSIBLE, WIT
    H"
D7 490 PRINT "A PIECE LIFTED FROM PLAY WHEN IT'S"
D3 500 PRINT "JUMPED."
5D 510 VTAB 12: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
```

GAMES OF SKILL

```

5A 520 GET S$
41 530 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 510
62 540 K1 = 0:K2 = 3
12 550 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
21 560 RETURN
59 570 REM VALUES
28 580 K = 20:N = 15: DIM HOLE(K,2),CX(N),CY(N),R(N)
    ,LM(18,3)
F0 590 Z = - 16336: REM CLICK
3F 600 REM X COORDINATES FOR HOLE
2E 610 DATA -2,3,-4,5,-6,7,-7,8,-8,9,-8,9,-9,10,-9,1
    0,-10,11,-10,11
08 620 FOR I = 1 TO K / 2
50 630 READ A,B
1C 640 HOLE(I,1) = A:HOLE(21 - I,1) = A
54 650 HOLE(I,2) = B:HOLE(21 - I,2) = B
0A 660 NEXT
BF 670 REM CENTER COORDINATES
0C 680 DATA 140,24,120,53,160,53,100,83,140,83,180,8
    3,80,114,120,114,160,114,200,114,60,143,100,1
    43,140,143,180,143,220,143
DC 690 FOR I = 1 TO N
E3 700 READ CX(I),CY(I)
01 710 NEXT
1B 720 RETURN
01 730 REM SHAPES
88 740 REM DIRECTORY
A1 750 DATA 16,0,34,0,45,0,56,0,65,0,76,0,88,0,98,0,
    111,0,122,0,131,0,140,0,153,0,162,0,174,0,184
    ,0,196,0
92 760 REM LETTERS (a to o)
55 770 DATA 3,40,45,50,54,63,63,32,41,45,0
C6 780 DATA 40,21,54,30,63,39,36,44,39,36,0
17 790 DATA 40,61,63,23,54,14,45,37,0
DC 800 DATA 56,23,54,14,45,37,36,60,37,60,0
F3 810 DATA 40,21,62,63,39,12,23,54,14,45,37,0
08 820 DATA 37,8,28,63,50,62,53,54,5,0
3F 830 DATA 40,21,54,54,59,39,9,56,63,32,12,5,0
08 840 DATA 40,21,54,62,27,35,36,44,39,44,0
9A 850 DATA 60,12,48,50,54,62,45,4,0
95 860 DATA 32,8,22,54,54,30,63,32,0
83 870 DATA 8,49,51,51,41,58,27,35,44,39,36,44,0
8D 880 DATA 36,60,53,54,54,46,63,7,0
33 890 DATA 12,53,54,62,3,32,36,59,54,54,5,0
74 900 DATA 40,21,54,62,27,35,36,44,5,0
53 910 DATA 40,21,54,30,63,7,32,36,41,5,6,0
3F 920 REM SQUARE

```


GAMES OF SKILL

```
E1 930 DATA 39,45,54,63,39,36,45,45,54,54,63,63,39,3
    6,36,45,45,45,54,54,54,63,63,63,39,36,36,36,4
    5,45,45,45,54,54,54,54,63,63,63,63,46,45,45,4
    5,45,36,36,36,36,36,0
A3 940 FOR I = 16384 TO 16630
AF 950 READ V
97 960 POKE I,V
0F 970 NEXT
E7 980 POKE 233,64: POKE 232,0: REM TABLE STARTS AT
    $4000
2B 990 RETURN
1B 1000 REM LEGAL MOVES (from, to, middle)
6B 1010 REM POSITIVE SLANT
81 1020 : DATA 1,4,2 : DATA 2,7,4
A2 1030 : DATA 4,11,7: DATA 3,8,5
55 1040 : DATA 5,12,8: DATA 6,13,9
3B 1050 REM NEGATIVE SLANT
BC 1060 : DATA 1,6,3 : DATA 3,10,6
40 1070 : DATA 6,15,10: DATA 2,9,5
A3 1080 : DATA 5,14,9: DATA 4,13,8
6A 1090 REM HORIZONTAL
D1 1100 : DATA 11,13,12: DATA 12,14,13
BA 1110 : DATA 13,15,14: DATA 7,9,8
AB 1120 : DATA 8,10,9: DATA 4,6,5
8E 1130 FOR I = 1 TO 18
1C 1140 FOR J = 1 TO 3
12 1150 READ LM(I,J)
07 1160 NEXT J,I
EF 1170 RETURN
7C 1180 REM PLAY GAME
75 1190 REM INITIAL POSITION
43 1200 GOSUB 1310
35 1210 REM ENTER MOVE
9F 1220 GOSUB 1890
D3 1230 REM MAKE MOVE
8D 1240 GOSUB 2380
47 1250 REM CHECK FOR END OF GAME
5D 1260 GOSUB 2500
31 1270 IF GAME$ = "ON" THEN 1220
33 1280 REM SHOW OUTCOME
A9 1290 GOSUB 2580
D7 1300 RETURN
59 1310 REM INITIAL POSITION
9B 1320 REM RECORD
75 1330 GOSUB 1450
5D 1340 REM PYRAMID
61 1350 GOSUB 1510
56 1360 REM HOLES
65 1370 GOSUB 1600
5E 1380 REM LINES
AD 1390 GOSUB 1680
```

GAMES OF SKILL

```
F4 1400 REM PIECES
6B 1410 GOSUB 1730
D5 1420 REM INITIAL HOLE
5F 1430 GOSUB 1800
E9 1440 RETURN
A9 1450 REM RECORD
5B 1460 FOR I = 1 TO N
2A 1470 R(I) = 1
C9 1480 NEXT
6B 1490 TALLY = 14
DB 1500 RETURN
55 1510 REM PYRAMID
92 1520 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= K1
43 1530 HPLLOT 1,1: CALL 62454
DD 1540 B = - 159 / 110: A = - B * 140: HCOLOR= K2
33 1550 FOR X = 140 TO 30 STEP - 1
04 1560 HPLLOT X,159 TO X,A + B * X
6E 1570 HPLLOT 280 - X,159 TO 280 - X,A + B * X
CB 1580 NEXT
FF 1590 RETURN
44 1600 REM HOLES
8C 1610 HCOLOR= 0
4F 1620 FOR I = 1 TO N
76 1630 X0 = CX(I):Y0 = CY(I) - 10
A7 1640 FOR J = 1 TO K
BA 1650 HPLLOT X0 + HOLE(J,1),Y0 + J TO X0 + HOLE(J,2
),Y0 + J
11 1660 NEXT J,I
F9 1670 RETURN
64 1680 REM LINES
6D 1690 HPLLOT 140,24 TO 60,143: HPLLOT 160,53 TO 100,
143: HPLLOT 180,83 TO 140,143
29 1700 HPLLOT 140,24 TO 220,143: HPLLOT 120,53 TO 180
,143: HPLLOT 100,83 TO 140,143
C7 1710 HPLLOT 100,83 TO 180,83: HPLLOT 80,114 TO 200,
114: HPLLOT 60,143 TO 220,143
E7 1720 RETURN
07 1730 REM PIECES
59 1740 FOR I = 1 TO N
EE 1750 X = CX(I):Y = CY(I)
69 1760 HCOLOR= 3: DRAW 16 AT X,Y
63 1770 HCOLOR= 0: DRAW I AT X,Y
CF 1780 NEXT
04 1790 RETURN
A9 1800 REM HOLE
CD 1810 VTAB 22: HTAB 13: PRINT "INITIAL HOLE ? ";BE
LL$:
6C 1820 GET S$
55 1830 A = ASC (S$): IF A > 96 THEN A = A - 32
A7 1840 P = A - 64
2B 1850 IF P < 1 OR P > N THEN 1810
```

GAMES OF SKILL

```

01 1860 R(P) = 0: HCOLOR= 0: DRAW 16 AT CX(P),CY(P)
08 1870 HCOLOR= 3: DRAW P AT CX(P),CY(P)
02 1880 RETURN
01 1890 REM ENTER MOVE
06 1900 REM PIECE TO MOVE
A5 1910 GOSUB 1980
E6 1920 REM PLACE TO PUT IT
7B 1930 GOSUB 2060
55 1940 REM CHECK LEGALITY
7B 1950 GOSUB 2240
0C 1960 IF MOVE$ = "ILLEGAL" THEN GOSUB 2320: GOTO 1
    910
FF 1970 RETURN
E6 1980 REM PIECE TO MOVE
EC 1990 VTAB 22: HTAB 12: PRINT "PIECE TO MOVE = ? "
    ;:CLICK = PEEK (Z)
55 2000 GET S$
3E 2010 A = ASC (S$): IF A > 96 THEN A = A - 32
E5 2020 P1 = A - 64
4B 2030 IF P1 < 1 OR P1 > N THEN 1990
60 2040 IF R(P1) = 0 THEN 1990
E6 2050 RETURN
E5 2060 REM PLACE TO PUT IT
7B 2070 VTAB 22: HTAB 12: PRINT SPC( 17)
01 2080 VTAB 22: HTAB 13: PRINT "HOLE TO FILL = ? ";
    ;:CLICK = PEEK (Z)
19 2090 GOSUB 2150: REM GET LETTER
6B 2100 IF A > 96 THEN A = A - 32
04 2110 P2 = A - 64
95 2120 IF P2 < 1 OR P2 > N THEN 2080
4F 2130 IF R(P2) = 1 THEN GOTO 2080
E4 2140 RETURN
54 2150 REM FLASH & GET
F5 2160 XDRAW 16 AT CX(P1),CY(P1)
63 2170 FOR PAUSE = 1 TO 10:P = PEEK ( - 16384): NEX
    T
77 2180 DRAW 16 AT CX(P1),CY(P1)
6B 2190 FOR PAUSE = 1 TO 10:P = PEEK ( - 16384): NEX
    T
3D 2200 IF P < 128 THEN 2160
D0 2210 POKE - 16368,0
41 2220 A = P - 128
E2 2230 RETURN
4B 2240 REM CHECK LEGALITY
7E 2250 MOVE$ = "ILLEGAL"
85 2260 REM F = from; T = to; M = middle
A1 2270 FOR I = 1 TO 18
E0 2280 F = LM(I,1):T = LM(I,2):M = LM(I,3)
F7 2290 IF ((F = P1 AND T = P2) OR (F = P2 AND T = P
    1)) AND R(M) = 1 THEN MOVE$ = "LEGAL":I = 18

```

GAMES OF SKILL

```

A8 2300 NEXT
DC 2310 RETURN
D7 2320 REM ILLEGAL MOVE
62 2330 VTAB 22: HTAB 13: PRINT SPC( 16)
18 2340 FLASH : VTAB 22: HTAB 17: PRINT "NAUGHTY !":
    NORMAL
89 2350 FOR PAUSE = 1 TO 400:CLICK = PEEK ( - 16336)
    : NEXT
33 2360 HCOLOR= 0: DRAW P1 AT CX(P1),CY(P1): HCOLOR=
    3
F4 2370 RETURN
EA 2380 REM MAKE MOVE
01 2390 DRAW 16 AT CX(P2),CY(P2)
B5 2400 HCOLOR= 0
F9 2410 DRAW P2 AT CX(P2),CY(P2)
65 2420 DRAW 16 AT CX(P1),CY(P1)
3B 2430 DRAW 16 AT CX(M),CY(M)
DD 2440 HCOLOR= 3
86 2450 DRAW P1 AT CX(P1),CY(P1)
20 2460 DRAW M AT CX(M),CY(M)
FF 2470 R(P1) = 0:R(M) = 0:R(P2) = 1
BF 2480 TALLY = TALLY - 1
FE 2490 RETURN
3A 2500 REM CHECK FOR END OF GAME
CA 2510 GAME$ = "OVER"
7B 2520 REM F = from; T = to; M = middle
97 2530 FOR I = 1 TO 18
26 2540 F = R(LM(I,1)):T = R(LM(I,2)):M = R(LM(I,3))
C1 2550 IF ((F = 1 AND T = 0) OR (F = 0 AND T = 1))
    AND M = 1 THEN GAME$ = "ON":I = 18
C4 2560 NEXT
F8 2570 RETURN
6A 2580 REM OUTCOME
96 2590 FLASH : VTAB 24: HTAB 13: PRINT "THE GAME'S
    OVER";: NORMAL
94 2600 FOR I = 1 TO 10: PRINT BELL$;: NEXT
70 2610 RANK$ = "YOU'VE JUST BEEN ENTOMBED."
FD 2620 IF TALLY = 1 THEN RANK$ = "HAIL YOU, THE NEW
    PHARAOH!"
65 2630 IF TALLY = 2 THEN RANK$ = "YOU WIN A SPHINX!"
    "
AD 2640 IF TALLY = 3 THEN RANK$ = "THREE LEFT, NOT B
    AD."
1E 2650 IF TALLY = 4 THEN RANK$ = "BACK TO THE QUARR
    Y."
D3 2660 VTAB 22: HTAB 21 - LEN (RANK$) / 2: PRINT RA
    NK$
89 2670 FOR PAUSE = 1 TO 5000: NEXT
FE 2680 RETURN

```

TERRAPIN'S TIC-TAC-TOE

Play against the Apple in this version of an old favorite. The computer is the terrapin, and you're the bunny. Try to get three of your markers in a row, in any direction, before the terrapin lines up three.

Two versions of the game are available: easy and difficult. The easy version is recommended for beginners, such as children in grammar school and adults who've never played before. In the difficult version the computer plays a perfect game. This doesn't mean that you'll always lose, but you will have to play perfectly to win. The game uses some animation as the bunny and terrapin.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-5A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-5B. You don't have to run Program 2-5A again.

Program 2-5A. Terrapin's Tic-Tac-Toe Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
EE 100 REM SHAPES FOR TIC-TAC-TOE
7C 110 REM DIRECTORY
C9 120 DATA 14,0,30,0,180,0,116,1,38,2,194,2,245,2,2
    54,2,10,3,23,3,34,3,47,3,60,3,70,3,84,3
DE 130 REM TERRAPIN #1
58 140 DATA 37,37,36,36,37,45,45,4,40,37,37,60,60,60
    ,62,60,62,46,53,46
E3 150 DATA 37,31,63,46,46,62,39,55,63,39,55,39,23,6
    2,62,62,46,62,62,46
21 160 DATA 62,46,62,46,62,46,46,62,53,31,43,42,45,5
    2,54,55,54,53,45,37
AB 170 DATA 63,60,44,37,39,45,45,50,54,53,45,37,63,6
    0,44,60,12,60,63,39
B9 180 DATA 45,45,37,63,63,63,40,45,45,37,61,63,63,6
    3,44,9,41,45,60,63
C3 190 DATA 31,63,35,45,13,45,45,28,63,63,59,39,45,4
    1,45,13,45,53,37,37
53 200 DATA 39,55,63,60,62,59,63,59,39,45,45,41,5,56
    ,63,63,39,45,45,45
```


GAMES OF SKILL

```

91 210 DATA 60,63,63,44,45,45,60,63,7,0
A3 220 REM RABBIT #1
E5 230 DATA 32,36,36,39,44,37,36,36,36,44,44,52,54,5
4,55,46,50,21,63,46
D4 240 DATA 53,63,46,63,63,60,36,45,36,36,7,32,59,23
,55,55,47,45,37,53
0A 250 DATA 61,54,62,46,46,46,54,63,62,62,55,55,63,6
2,46,54,55,47,46,36
8B 260 DATA 44,37,39,45,36,37,37,45,46,44,44,52,46,4
6,46,46,46,54,46,62
9F 270 DATA 62,44,36,63,39,45,60,63,44,60,60,55,63,5
5,55,45,44,53,55,63
DD 280 DATA 63,46,45,45,44,54,63,63,63,55,13,45,45,4
5,21,31,55,53,45,40
2D 290 DATA 58,50,62,54,45,45,46,46,62,62,36,39,5
5,46,62,60,36,55,62
8F 300 DATA 36,55,39,36,36,37,63,54,54,62,59,62,63,6
2,63,62,60,62,60,44
95 310 DATA 44,46,36,53,46,36,53,38,37,53,37,45,60,6
3,60,36,36,37,54,54
E9 320 DATA 53,45,60,60,36,45,53,61,38,63,7,0
61 330 REM TERRAPIN #2
50 340 DATA 36,36,36,36,44,36,36,39,37,37,53,37,53,3
7,21,62,55,61,63,35
7D 350 DATA 54,53,53,61,63,52,54,55,46,45,46,44,44,4
4,36,53,37,21,62,62
E0 360 DATA 52,55,55,61,62,52,55,55,46,54,54,62,54,5
5,46,21,54,55,46,62
25 370 DATA 39,36,39,45,60,63,58,32,37,37,44,36,37,3
6,39,36,60,60,54,53
93 380 DATA 55,53,55,45,62,54,55,62,62,54,62,54,54,4
5,62,63,60,44,60,44
E4 390 DATA 36,37,32,37,37,44,60,60,36,36,36,36,28,2
2,54,54,54,54,53,62
18 400 DATA 62,54,58,54,39,36,37,36,37,61,36,36,36,4
,32,24,122,23,23,23
63 410 DATA 31,36,61,60,62,46,62,53,53,47,45,45,62,6
3,55,41,45,54,63,46
FF 420 DATA 53,63,46,62,46,62,54,39,55,60,60,28,13,3
6,36,36,41,0
C7 430 REM RABBIT #2
D3 440 DATA 36,36,36,53,46,32,36,37,47,44,36,37,52,5
5,55,62,39,60,60,52
AE 450 DATA 53,54,62,63,50,41,44,46,45,13,36,37,37,3
7,36,37,21,53,62,38
3E 460 DATA 60,54,59,54,54,30,62,60,54,55,61,55,53,4
6,54,55,54,45,52,54
64 470 DATA 49,46,54,46,46,46,54,39,39,63,44,63,44,4
,56,36,55,54,38,39

```

GAMES OF SKILL

```
25 480 DATA 36,44,39,39,60,47,54,46,62,56,60,55,54,5
5,62,60,44,60,39,39
90 490 DATA 60,36,53,53,46,46,4,56,45,46,44,39,63,44
,44,38,45,45,44,39
06 500 DATA 60,52,54,63,36,36,39,39,60,39,7,56,58,60
,60,36,37,62,62,63
39 510 DATA 53,54,44,44,53,53,53,14,45,62,53,53,53,5
4,6,0
38 520 REM SQUARE
03 530 DATA 36,36,45,53,54,54,54,62,36,36,36,60,54,5
4,55,53,62,39,61,36
06 540 DATA 36,36,60,54,54,54,54,39,36,36,36,36,45,4
5,45,53,54,54,54,54
82 550 DATA 62,63,63,63,39,36,36,36,36,44,0
75 560 REM NUMBERS (1 to 9)
58 570 DATA 36,60,42,54,54,46,63,7,0
2A 580 DATA 45,32,28,63,23,22,17,23,46,45,37,0
C3 590 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
07 600 DATA 33,36,23,23,23,46,45,61,54,6,0
7E 610 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
C4 620 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
A6 630 DATA 12,12,60,63,55,18,17,54,6,0
FE 640 DATA 45,32,28,63,23,54,49,51,14,45,5,32,4,0
39 650 DATA 39,35,12,45,21,54,47,54,51,59,39,0
09 660 FOR I = 16384 TO 17247
B0 670 READ V
98 680 POKE I,V
10 690 NEXT
96 700 PRINT CHR$(4);"BSAVE TTT.SHAPE,A16384,L864"
91 710 END
```

Program 2-5B. Terrapin's Tic-Tac-Toe

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
17 100 LOMEM: 17500
AA 110 REM TERRAPIN'S TIC-TAC-TOE
AB 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
4F 150 GOSUB 640
EC 160 REM PLAY AGAIN
8F 170 VTB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
9B 210 TEXT : HOME : PRINT "BYE-BYE, BUNNY"
8E 220 END
```

GAMES OF SKILL

```
AB 230 REM INITIALIZE
2B 240 REM TITLE
4B 250 GOSUB 330
8B 260 REM INSTRUCTIONS
5B 270 GOSUB 390
5B 280 REM VALUES
60 290 GOSUB 490
F6 300 REM SHAPES
50 310 GOSUB 580
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$( 21): TEXT : HOME
CA 350 VTAB 12: HTAB 9: PRINT "TERRAPIN'S TIC-TAC-TO
E"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$( 7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
52 410 PRINT "I'M THE TERRAPIN. AND YOU'RE THE BUNNY
."
7B 420 PRINT "TRY TO GET THREE IN A ROW BEFORE ME."
2B 430 VTAB 5: HTAB 1: PRINT "ARE YOU USING A COLOR
MONITOR (Y/N) ? ";BELL$;
5D 440 GET S$
05 450 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
ND S$ < > "n" THEN 430
94 460 K(1) = 3:K(2) = 3
2F 470 IF S$ = "Y" OR S$ = "y" THEN K(1) = 6:K(2) =
5
24 480 RETURN
5C 490 REM VALUES
84 500 DIM B(3,3)
C7 510 : REM ROW & COL OF EACH DIGIT (1 TO 9)
5B 520 DEF FN ROW(V) = INT ((V - 1) / 3) + 1
E3 530 DEF FN COL(V) = V - 3 * INT ((V - 1) / 3)
E3 540 : REM X & Y COORDINATES
1B 550 DEF FN X(V) = 65 * V + 10
85 560 DEF FN Y(V) = 53 * V - 26
23 570 RETURN
09 580 REM SHAPES
5A 590 HOME
97 600 VTAB 12: HTAB 16: PRINT "READING"
06 610 PRINT CHR$( 4);"BLOAD TTT.SHAPE"
95 620 POKE 233,64: POKE 232,0
1C 630 RETURN
9F 640 REM PLAY
5B 650 : REM INITIALIZE
5D 660 GOSUB 770
90 670 : REM ENTER MOVE
```

GAMES OF SKILL

```
88 680 ON PLAYER GOSUB 1340,2040
28 690 : REM MAKE MOVE
06 700 GOSUB 2140
07 710 : REM CHECK FOR END
E6 720 GOSUB 2360
8A 730 IF GAME$ = "ON" THEN PLAYER = 3 - PLAYER: GOT
    O 680
90 740 : REM OUTCOME
E4 750 GOSUB 2530
23 760 RETURN
88 770 REM INITIALIZE
61 780 REM DIFFICULTY
69 790 GOSUB 890
94 800 REM FIRST PLAYER UP
58 810 GOSUB 990
78 820 REM SQUARES
EE 830 GOSUB 1090
C5 840 REM LABELS
F4 850 GOSUB 1190
02 860 REM RECORD
F2 870 GOSUB 1270
28 880 RETURN
64 890 REM DIFFICULTY
14 900 HOME : TEXT
25 910 VTAB 8: HTAB 15: PRINT "DIFFICULTY"
73 920 VTAB 10: HTAB 16: INVERSE : PRINT "1": NORMA
    L : PRINT " EASY"
4E 930 VTAB 12: HTAB 16: INVERSE : PRINT "2": NORMA
    L : PRINT " HARD"
76 940 VTAB 15: HTAB 15: PRINT "CHOICE = ? ";BELL$;
64 950 GET S$
F7 960 DF = VAL (S$)
2C 970 IF DF < 1 OR DF > 2 THEN 940
29 980 RETURN
8C 990 REM FIRST UP
38 1000 HOME
F8 1010 VTAB 12: HTAB 8: PRINT "MAY I GO FIRST (Y/N)
    = ? ";BELL$;
5C 1020 GET S$
45 1030 A = ASC (S$): IF A > 96 THEN A = A - 32
85 1040 L$ = CHR$ (A)
17 1050 IF L$ < > "Y" AND L$ < > "N" THEN 1010
67 1060 PLAYER = 1
C4 1070 IF L$ = "N" THEN PLAYER = 2
F1 1080 RETURN
84 1090 REM SQUARES
8A 1100 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= K(1)
14 1110 FOR R = 1 TO 3
98 1120 FOR C = 1 TO 3
09 1130 X = 65 * C - 15
```

GAMES OF SKILL

```

42 1140 Y = 53 * R - 48
D0 1150 FOR L = Y TO Y + 44
5A 1160 HPL0T X,L TO X + 50,L
87 1170 NEXT L,C,R
F3 1180 RETURN
06 1190 REM LABEL
ED 1200 FOR I = 1 TO 9
CE 1210 R = FN ROW(I):C = FN COL(I)
5C 1220 X = FN X(C):Y = FN Y(R)
21 1230 HCOLOR= 0: DRAW 5 AT X,Y
97 1240 HCOLOR= 3: DRAW I + 5 AT X,Y
B9 1250 NEXT
ED 1260 RETURN
6E 1270 REM RECORD (0=BLANK; 1=APPLE; 9=RABBIT)
AD 1280 FOR I = 1 TO 3
32 1290 FOR J = 1 TO 3
06 1300 B(I,J) = 0
F6 1310 NEXT J,I
EA 1320 MOVES = 0
E3 1330 RETURN
05 1340 REM APPLE'S TURN
E5 1350 R = 0:C = 0
B2 1360 M$ = "MY TURN ... I'M THINKING": GOSUB 1500
ED 1370 : REM APPLE WINS
71 1380 V = 2: GOSUB 1550
33 1390 : REM HUMAN WINS
59 1400 IF R = 0 THEN V = 18: GOSUB 1550
7F 1410 : REM APPLE WINS IN 2 MOVES
A6 1420 IF DF = 2 AND R = 0 THEN V = 2: GOSUB 1800
C4 1430 : REM HUMAN WINS IN 2 MOVES
27 1440 IF DF = 2 AND R = 0 THEN V = 18: GOSUB 1800
F7 1450 : REM VACANT CORNER SQUARE
B8 1460 IF DF = 2 AND R = 0 THEN GOSUB 1880
22 1470 : REM ANY VACANT SQUARE
6D 1480 IF R = 0 THEN GOSUB 1960
FD 1490 RETURN
07 1500 REM DISPLAY MESSAGE
1B 1510 L = LEN (M$)
9E 1520 VTAB 22: HTAB 9: PRINT SPC( 24)
EC 1530 VTAB 22: HTAB 21 - L / 2: PRINT M$:
EB 1540 RETURN
BD 1550 REM WIN IN 1 MOVE
58 1560 CNT = 0
50 1570 : REM ROW & COL
B3 1580 FOR I = 1 TO 3
96 1590 SROW = 0:SCOL = 0:CLICK = PEEK (2)
16 1600 FOR J = 1 TO 3
A5 1610 SROW = SROW + B(I,J)
52 1620 SCOL = SCOL + B(J,I)
3D 1630 IF B(I,J) = 0 THEN COL = J

```


GAMES OF SKILL

```

2B 1640 IF B(J,I) = 0 THEN ROW = J
8C 1650 NEXT J
EF 1660 IF SROW = V THEN R = I:C = COL: CNT = CNT + 1
F7 1670 IF SCOL = V THEN R = ROW:C = I: CNT = CNT + 1
97 1680 NEXT I
29 1690 : REM - & + SLANTS
D1 1700 SNGT = 0: SPST = 0
9B 1710 FOR I = 1 TO 3
23 1720 SNGT = SNGT + B(I,I)
70 1730 SPST = SPST + B(I,4 - I)
6B 1740 IF B(I,I) = 0 THEN NGT = I
4E 1750 IF B(I,4 - I) = 0 THEN PST = I
C7 1760 NEXT
D0 1770 IF SNGT = V THEN R = NGT:C = NGT: CNT = CNT +
1
5F 1780 IF SPST = V THEN R = PST:C = 4 - PST: CNT = C
NT + 1
04 1790 RETURN
67 1800 REM WIN IN 2 MOVES
1F 1810 FOR L = 1 TO 3
A3 1820 FOR M = 1 TO 3
E1 1830 : REM PLACE MARKER & CHECK FOR POSSIBILITY O
F TWO 3-IN-A-ROWS
35 1840 IF B(L,M) = 0 THEN B(L,M) = INT (V / 2): GOS
UB 1550: B(L,M) = 0: R = 0: C = 0
C5 1850 IF CNT = 2 THEN R = L: C = M: M = 3: L = 3
24 1860 NEXT M,L
FD 1870 RETURN
DF 1880 REM VACANT CORNER
30 1890 K = 0
42 1900 IF B(1,1) = 0 THEN K = K + 1: R(K) = 1: C(K) =
1
6E 1910 IF B(1,3) = 0 THEN K = K + 1: R(K) = 1: C(K) =
3
9C 1920 IF B(3,1) = 0 THEN K = K + 1: R(K) = 3: C(K) =
1
B8 1930 IF B(3,3) = 0 THEN K = K + 1: R(K) = 3: C(K) =
3
A8 1940 IF K > 0 THEN I = INT (K * RND (1)) + 1: R =
R(I): C = C(I)
F7 1950 RETURN
01 1960 REM ANY VACANT SQUARE
2A 1970 K = 0
BB 1980 FOR I = 1 TO 3
40 1990 FOR J = 1 TO 3
42 2000 IF B(I,J) = 0 THEN K = K + 1: R(K) = I: C(K) =
J
F1 2010 NEXT J,I
C9 2020 I = INT (K * RND (1)) + 1: R = R(I): C = C(I)
DE 2030 RETURN

```

GAMES OF SKILL

```

9E 2040 REM HUMAN'S TURN
9A 2050 M$ = "YOUR TURN, BUNNY": GOSUB 1500
95 2060 VTAB 24: HTAB 17: INVERSE : PRINT "SQUARE";:
    NORMAL : PRINT CHR$ (32);BELL$;
71 2070 GET S$
15 2080 Q = VAL (S$)
E5 2090 IF Q < 1 OR Q > 9 THEN 2060
4E 2100 R = FN ROW(Q):C = FN COL(Q)
02 2110 IF B(R,C) < > 0 THEN 2060
FB 2120 VTAB 24: HTAB 17: PRINT SPC( 6);
E0 2130 RETURN
06 2140 REM MAKE MOVE
35 2150 : REM DRAW BLACK RECTANGLE
6B 2160 X = FN X(C):Y = FN Y(R)
CB 2170 HCOLOR= 0
C2 2180 FOR L = Y - 19 TO Y + 19
0F 2190 HPLLOT X - 21,L TO X + 21,L
A6 2200 NEXT
74 2210 : REM DRAW JUMPING PLAYER
82 2220 GOSUB 2280
D5 2230 HCOLOR= K(PLAYER): DRAW PLAYER AT X,Y
80 2240 : REM RECORD
F6 2250 B(R,C) = (PLAYER = 2) * 9 + (PLAYER = 1) * 1
8F 2260 MOVES = MOVES + 1
F2 2270 RETURN
F3 2280 REM JUMP
3B 2290 FOR JUMPS = 1 TO 3
C7 2300 FOR J = 0 TO 2 STEP 2
98 2310 HCOLOR= K(PLAYER): DRAW J + PLAYER AT X,Y
AA 2320 FOR PAUSE = 1 TO 150: NEXT PAUSE
11 2330 HCOLOR= 0: DRAW J + PLAYER AT X,Y
A2 2340 NEXT J,JUMPS
EC 2350 RETURN
CD 2360 REM CHECK FOR END
11 2370 GAME$ = "ON":V = 24 * PLAYER - 21:SQ(1) = 0
62 2380 : REM ROWS & COLS
B4 2390 FOR I = 1 TO 3
C9 2400 ROW(I) = 0:COL(I) = 0
17 2410 FOR J = 1 TO 3
9A 2420 ROW(I) = ROW(I) + B(I,J)
E0 2430 COL(I) = COL(I) + B(J,I)
85 2440 NEXT J
CD 2450 IF ROW(I) = V THEN SQ(1) = 3 * I - 2:SQ(2) =
    SQ(1) + 1:SQ(3) = SQ(2) + 1
96 2460 IF COL(I) = V THEN SQ(1) = I:SQ(2) = I + 3:S
    Q(3) = I + 6
90 2470 NEXT I
95 2480 : REM SLANTS
50 2490 IF B(1,1) + B(2,2) + B(3,3) = V THEN SQ(1) =
    1:SQ(2) = 5:SQ(3) = 9

```

GAMES OF SKILL

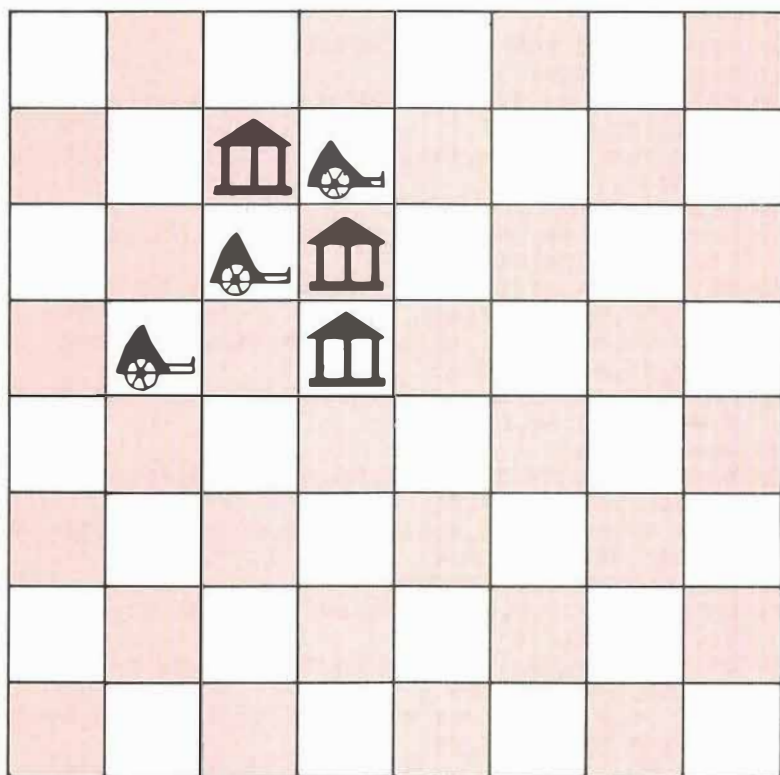
```
34 2500 IF B(1,3) + B(2,2) + B(3,1) = V THEN SQ(1) =  
3:SQ(2) = 5:SQ(3) = 7  
3A 2510 IF SQ(1) < > 0 OR MOVES = 9 THEN GAME$ = "OV  
ER"  
E4 2520 RETURN  
56 2530 REM OUTCOME  
A2 2540 : REM MESSAGE  
28 2550 M$ = "WE TIE, BUNNY"  
50 2560 M$(1) = "I WIN, SMARTY TAIL !"  
A5 2570 M$(2) = "YOU WIN ... SIGH."  
74 2580 IF SQ(1) > 0 THEN M$ = M$(PLAYER)  
6E 2590 GOSUB 1500  
D0 2600 : REM DANCING  
32 2610 IF SQ(1) > 0 THEN GOSUB 2630  
E6 2620 RETURN  
06 2630 REM PIECES  
B3 2640 FOR PAUSE = 1 TO 15: PRINT BELL$;: NEXT  
AA 2650 FOR I = 1 TO 3  
3A 2660 R = FN ROW(SQ(I)):C = FN COL(SQ(I))  
39 2670 X = FN X(C):Y = FN Y(R): GOSUB 2280  
0A 2680 HCOLOR= K(PLOYER): DRAW 2 + PLAYER AT X,Y  
9C 2690 NEXT I  
E0 2700 RETURN
```

ROMAN CHECKERS

Your goal in this exciting game of wits is to line up five of your chariots on an 8×8 board before the Apple lines up five of its pieces, which are replicas of the Pantheon.

Either side goes first, and you and the Apple alternate turns. You're allowed to place a chariot on any vacant square, light or dark (see Figure 2-5). The first side to get five markers in a row, either vertically, horizontally, or diagonally, wins the contest.

Figure 2-5. Roman Checkers



The Apple plays exceedingly well in this game. After the first couple of turns, it takes about 30 seconds to search the board for an optimal move. You'll have to think ahead in order to win. But you're Caesar, after all, and that shouldn't be too hard.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-6A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-6B. You don't have to run Program 2-6A again.

Program 2-6A. Roman Checkers Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
4C 100 REM SHAPES FOR ROMAN CHECKERS
7C 110 REM DIRECTORY
7E 120 DATA 19,0,40,0,121,0,162,0,95,1,104,1,116,1,1
    29,1,140,1,153,1
EF 130 DATA 166,1,177,1,191,1,204,1,217,1,229,1,241,
    1,253,1,7,2,18,2
40 140 REM PANTHEON
77 150 DATA 9,36,44,54,54,55,53,55,53,55,45,45,36,36
    ,36,36,44,54,54,54
A0 160 DATA 54,54,61,63,63,63,60,62,60,36,36,36,36,6
    0,54,54,54,54,61
89 170 DATA 39,55,63,47,44,60,44,60,44,60,44,60,44,6
    0,60,45,45,45,45,45
CA 180 DATA 45,45,45,63,60,63,63,63,63,47,37,45,4
    5,45,45,63,60,63,63,0
44 190 REM CHARIOT
D8 200 DATA 46,36,36,36,52,54,55,62,38,60,62,60,58,6
    2,62,62,45,50,37,36
D9 210 DATA 49,50,58,53,45,60,36,32,53,50,49,5,32,39
    ,13,45,45,45,37,4,0
FA 220 REM CHECKERED PATTERN
65 230 DATA 9,9,9,9,9,18,18,18,18,31,31,31,31,31,31,
    31,31,31,31,12
40 240 DATA 13,13,13,13,13,13,13,13,13,5,56,59,59,59
    ,59,59,59,59,59,59
BE 250 DATA 35,41,41,41,41,41,41,41,41,41,56,59,5
    9,59,59,59,59,59,59
A6 260 DATA 59,35,41,41,41,41,41,41,41,41,41,56,5
    9,59,59,59,59,59,59
D7 270 DATA 59,59,35,41,41,41,41,41,41,41,41,41,5
    6,59,59,59,59,59,59
```

GAMES OF SKILL

```

53 280 DATA 59,59,59,35,41,41,41,41,41,41,41,41,41,4
    1,56,59,59,59,59,59
21 290 DATA 59,59,59,59,35,41,41,41,41,41,41,41,41,4
    1,41,56,59,59,59,59
6E 300 DATA 59,59,59,59,59,35,41,41,41,41,41,41,41,4
    1,41,41,56,59,59,59
63 310 DATA 59,59,59,59,59,59,35,41,41,41,41,41,41,4
    1,41,41,41,56,59,59
E0 320 DATA 59,59,59,59,59,59,59,35,0
F3 330 REM DIGITS 1 TO 8
50 340 DATA 36,60,42,54,54,46,63,7,0
22 350 DATA 45,32,28,63,23,22,17,23,46,45,37,0
88 360 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
12 370 DATA 33,36,23,23,23,46,45,61,54,6,0
89 380 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
CF 390 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
45 400 DATA 30,54,36,5,40,40,32,63,63,7,0
EC 410 DATA 45,50,30,63,7,32,12,28,36,41,45,50,6,0
27 420 REM LETTERS A TO H
10 430 DATA 58,55,38,36,36,33,41,42,50,62,53,54,0
83 440 DATA 63,36,44,45,21,54,43,50,30,63,39,36,0
54 450 DATA 1,8,32,59,63,50,54,54,41,45,32,0
3C 460 DATA 9,54,30,63,39,36,36,44,45,21,54,0
A2 470 DATA 47,37,8,56,63,55,54,54,46,45,45,0
FE 480 DATA 61,63,54,38,36,36,44,45,53,0
BF 490 DATA 10,53,62,63,28,36,36,12,45,45,0
D7 500 DATA 45,36,60,27,51,54,61,54,46,9,33,36,0
CB 510 FOR I = 16384 TO 16926
A5 520 READ V
8D 530 POKE I,V
05 540 NEXT
03 550 PRINT CHR$(4); "BSAVE RC.SHAPE,A16384,L543"
99 560 END

```

Program 2-6B. Roman Checkers

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

EE 100 LOMEM: 17000
A2 110 REM ROMAN CHECKERS
A8 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
51 150 GOSUB 840
EC 160 REM PLAY AGAIN
10 170 VTAB 24: HTAB 13: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150

```


GAMES OF SKILL

```
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
28 240 REM TITLE
48 250 GOSUB 330
88 260 REM INSTRUCTIONS
58 270 GOSUB 390
58 280 REM VALUES
61 290 GOSUB 590
F6 300 REM SHAPES
52 310 GOSUB 780
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$ (21): TEXT : HOME
61 350 VTAB 12: HTAB 14: PRINT "ROMAN CHECKERS"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
68 410 PRINT "MY MARKER IS THE PANTHEON, AN ANCIENT"
80 420 PRINT "ROMAN TEMPLE. AND YOURS IS CAESAR'S"
F3 430 PRINT "CHARIOT.": PRINT
39 440 PRINT "TRY TO GET FIVE OF YOUR PIECES IN A RO
W"
1D 450 PRINT "BEFORE I DO.": PRINT
0C 460 PRINT "TO QUIT THE GAME, HIT ";: INVERSE : PR
INT "ESC";: NORMAL : PRINT "APE ON YOUR"
97 470 PRINT "TURN."
68 480 VTAB 13: HTAB 1: PRINT "ARE YOU USING A COLOR
MONITOR (Y/N) ? ";BELL$;
67 490 GET S$
7E 500 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
ND S$ < > "n" THEN 480
88 510 K(1) = 3:K(2) = 3
1E 520 IF S$ = "Y" OR S$ = "y" THEN K(1) = 5:K(2) =
6
37 530 : REM RUN OFF RANDOM NUMBERS
95 540 HOME : VTAB 12: HTAB 6: INVERSE : PRINT "N/L"
;: NORMAL : PRINT " STANDS FOR NUMBER/LETTER.
"
89 550 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY"
E5 560 R = RND (1): IF PEEK ( - 16384) < 128 THEN 56
0
1E 570 POKE - 16368,0
25 580 RETURN
5D 590 REM VALUES
68 600 DIM B(100),R(100)
DE 610 : REM X & Y COORDINATES
```

GAMES OF SKILL

```
11 620 DEF FN X(V) = 22 * V + 46
BB 630 DEF FN Y(V) = 18 * V + 3
BB 640 : REM DIRECTION DELTAS
51 650 DATA 1,9,10,11
EF 660 FOR I = 1 TO 4: READ DR(I): NEXT
50 670 : REM PIECES
9A 680 APPLE = 1:HUMAN = 2
56 690 : REM RANDOM FIRST MOVES
B3 700 DATA 34,37,45,46,55,56,64,67
0F 710 FOR I = 1 TO 8: READ RM(I): NEXT
1C 720 : REM OFF-BOARD SQUARES
F3 730 FOR I = 1 TO 10
0A 740 B(I) = - 9:B(90 + I) = - 9
40 750 B(10 * I) = - 9:B(10 * I - 9) = - 9
0B 760 NEXT
25 770 RETURN
0B 780 REM SHAPES
5C 790 HOME
1A 800 VTAB 12: HTAB 17: PRINT "READING"
34 810 PRINT CHR$(4);"BLOAD RC.SHAPE"
97 820 POKE 233,64: POKE 232,0
1E 830 RETURN
A1 840 REM PLAY
5A 850 : REM INITIALIZE
61 860 GOSUB 970
F6 870 : REM CHOOSE SQUARE
59 880 ON PLAYER GOSUB 1460,2360
2D 890 : REM MAKE MOVE
51 900 IF GAME$ < > "QUIT" THEN GOSUB 2230
09 910 : REM CHECK FOR END
46 920 IF GAME$ < > "QUIT" THEN GOSUB 2590
8D 930 IF GAME$ = "ON" THEN PLAYER = 3 - PLAYER: GOT
    O 880
2F 940 : REM DISPLAY OUTCOME
E6 950 GOSUB 2720
25 960 RETURN
BA 970 REM INITIALIZE
33 980 : REM FIRST PLAYER UP
F3 990 GOSUB 1070
06 1000 : REM BOARD
6B 1010 GOSUB 1170
92 1020 : REM LABELS
53 1030 GOSUB 1320
7B 1040 : REM RECORD
0B 1050 GOSUB 1380
E9 1060 RETURN
11 1070 REM FIRST UP
7B 1080 TEXT : HOME
1C 1090 VTAB 12: HTAB 8: PRINT "MAY I GO FIRST (Y/N)
    = ? ";BELL$;
```

GAMES OF SKILL

```
56 1100 GET S$
3F 1110 A = ASC (S$): IF A > 96 THEN A = A - 32
AF 1120 L$ = CHR$ (A)
12 1130 IF L$ < > "Y" AND L$ < > "N" THEN 1090
61 1140 PLAYER = 1
BE 1150 IF L$ = "N" THEN PLAYER = 2
EB 1160 RETURN
F8 1170 REM BOARD
84 1180 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= 3
97 1190 : REM SQUARES
62 1200 FOR R = 1 TO 8
DE 1210 FOR C = 1 TO 8
D1 1220 IF (R + C) / 2 = INT ((R + C) / 2) THEN DRAW
      3 AT FN X(C), FN Y(R)
1A 1230 NEXT C,R
D4 1240 : REM LINES
D8 1250 FOR I = 57 TO 233 STEP 22
25 1260 HPLT I,13 TO I,155
C1 1270 NEXT
58 1280 FOR I = 12 TO 156 STEP 18
6A 1290 HPLT 57,I TO 233,I
A7 1300 NEXT
DB 1310 RETURN
ED 1320 REM LABEL
EB 1330 FOR I = 1 TO 8
BB 1340 DRAW I + 3 AT 40, FN Y(I)
BD 1350 DRAW I + 11 AT FN X(I),4
BF 1360 NEXT
F3 1370 RETURN
B3 1380 REM RECORD
04 1390 FOR I = 1 TO 8
74 1400 FOR J = 2 TO 9
07 1410 B(I * 10 + J) = 0
FC 1420 NEXT J,I
83 1430 N = 0: REM NUMBER OF MOVES
EB 1440 GAME$ = "ON"
ED 1450 RETURN
0F 1460 REM APPLE'S TURN
D9 1470 VTAB 22: HTAB 14: PRINT SPC( 14);: HTAB 17:
      PRINT "MY TURN ...";
D1 1480 MOVE = 0:HMOVE = 0
FD 1490 : REM FIRST MOVES
7F 1500 IF N < = 2 THEN GOSUB 1600
33 1510 : REM CHECK FOR VICTORY
5D 1520 IF MOVE = 0 THEN GOSUB 1650
BE 1530 : REM TRY TO BLOCK HUMAN
66 1540 IF MOVE = 0 THEN GOSUB 1860
BF 1550 : REM TRY FOR AT LEAST 3 IN ROW
7B 1560 IF MOVE = 0 THEN P = APPLE: GOSUB 1910
BF 1570 : REM MOVE RANDOMLY
```

GAMES OF SKILL

```

53 1580 IF MOVE = 0 THEN GOSUB 2130
FF 1590 RETURN
CC 1600 REM FIRST MOVES
30 1610 V = INT ( RND (1) * 8) + 1
C2 1620 MOVE = RM(V): IF B(MOVE) < > 0 THEN 1610
B4 1630 FOR PAUSE = 1 TO 7500: NEXT
ED 1640 RETURN
CB 1650 REM VICTORY
94 1660 FOR I = 12 TO 89
78 1670 IF B(I) < > 0 THEN 1730
46 1680 FOR J = 1 TO 4
9F 1690 GOSUB 1750
7B 1700 IF K >= 4 THEN MOVE = I:GAME$ = "APPLE":J =
    4:I = 89
F2 1710 IF K = 3 AND FH$ = "OKAY" AND SH$ = "OKAY" T
    HEN HMOVE = I
82 1720 NEXT J
85 1730 NEXT I
EF 1740 RETURN
FF 1750 REM SEARCH
55 1760 K = 0:DLT = DR(J):FH$ = "":SH$ = ""
2C 1770 : REM FIRST HALF
55 1780 SQ = I
7C 1790 SQ = SQ + DLT: IF B(SQ) = 1 THEN K = K + 1:
    GOTO 1790
5B 1800 IF B(SQ) = 0 THEN FH$ = "OKAY"
8B 1810 REM SECOND HALF
3F 1820 SQ = I
A7 1830 SQ = SQ - DLT: IF B(SQ) = 1 THEN K = K + 1:
    GOTO 1830
85 1840 IF B(SQ) = 0 THEN SH$ = "OKAY"
F5 1850 RETURN
2D 1860 : REM BLOCK HUMAN
C7 1870 P = HUMAN: GOSUB 1910
B2 1880 : REM APPLE WINS IN TWO MOVES UNLESS HUMAN H
    AS 4 IN ROW
23 1890 IF HMOVE < > 0 AND NR < 4 THEN MOVE = HMOVE
E3 1900 RETURN
61 1910 REM 3 OR MORE IN ROW
95 1920 HLD = 0:NR = 0
8E 1930 FOR I = 12 TO 89
48 1940 NTIMES = 0
54 1950 IF B(I) < > 0 THEN 2020
44 1960 FOR J = 1 TO 4
7B 1970 GOSUB 2040
6A 1980 IF K > NR THEN NR = K:HLD = 0
22 1990 IF K = NR AND NR >= 2 THEN NTIMES = NTIMES
    + 1
6D 2000 NEXT J
6D 2010 IF NTIMES > HLD THEN HLD = NTIMES:MOVE = I

```

GAMES OF SKILL

```

74 2020 NEXT I
DE 2030 RETURN
45 2040 REM # OF PIECES IN LINE
ED 2050 K = 0: DLT = DR(J)
1B 2060 : REM FIRST HALF
44 2070 SQ = I
11 2080 SQ = SQ + DLT: IF B(SQ) = P THEN K = K + 1:
    GOTO 2080
51 2090 : REM SECOND
2A 2100 SQ = I
B7 2110 SQ = SQ - DLT: IF B(SQ) = P THEN K = K + 1:
    GOTO 2110
DC 2120 RETURN
B3 2130 REM MOVE RANDOMLY
DA 2140 : REM GET VACANT SQUARES
4D 2150 CNT = 0
8B 2160 FOR I = 12 TO 89
BA 2170 IF B(I) = 0 THEN CNT = CNT + 1: R(CNT) = I
C4 2180 NEXT
E9 2190 : REM CHOOSE
70 2200 V = INT (CNT * RND (1)) + 1
2B 2210 MOVE = R(V)
DE 2220 RETURN
41 2230 REM MOVE
D3 2240 RW = INT (MOVE / 10): CL = MOVE - RW * 10 - 1
5D 2250 X = FN X(CL): Y = FN Y(RW)
2A 2260 HCOLOR = 0: DRAW 3 AT X, Y
A5 2270 KR(1) = K(PLAYER): KR(2) = 0: KR(3) = KR(1)
30 2280 FOR L = 1 TO 3
81 2290 HCOLOR = KR(L): DRAW PLAYER AT X, Y
3F 2300 SOUND = PEEK (Z)
9D 2310 FOR PAUSE = 1 TO 200: NEXT PAUSE
7D 2320 NEXT L
71 2330 B(MOVE) = PLAYER
52 2340 N = N + 1
EC 2350 RETURN
AC 2360 REM HUMAN'S TURN
AF 2370 COL(1) = 25: COL(2) = 27
E2 2380 NORMAL : VTAB 22: HTAB 14: PRINT "YOUR TURN:
    ";: INVERSE : PRINT "N/L"
F0 2390 : REM GET NUMBER & LETTER
82 2400 FOR I = 1 TO 2
92 2410 GOSUB 2490
B2 2420 NEXT
CB 2430 : REM CHECK LEGALITY
5F 2440 IF GAME$ = "QUIT" THEN 2470
46 2450 MOVE = V(1) * 10 + V(2) + 1
44 2460 IF B(MOVE) < > 0 THEN PRINT BELL$,: GOTO 238
    0
5E 2470 NORMAL

```

GAMES OF SKILL

```
FA 2480 RETURN
35 2490 REM GET
96 2500 VTAB 22: HTAB COL(I)
50 2510 GET S$:A = ASC (S$): IF A > 96 THEN A = A -
    32
95 2520 IF A = 27 THEN GAME$ = "QUIT":I = 2: GOTO 25
    80
F7 2530 IF I = 1 THEN V = A - 48
F0 2540 IF I = 2 THEN V = A - 64
F0 2550 IF V < 1 OR V > 8 THEN PRINT BELL$;: GOTO 25
    00
B3 2560 V(I) = V
7E 2570 PRINT CHR$ (A)
FC 2580 RETURN
DD 2590 REM CHECK FOR END
3D 2600 : REM VICTORY BY HUMAN
53 2610 IF PLAYER = 2 THEN GOSUB 2650
AE 2620 : REM MOVES EXHAUSTED
B2 2630 IF GAME$ = "ON" AND N = 64 THEN GAME$ = "OVE
    R"
EE 2640 RETURN
93 2650 REM HUMAN WIN
D6 2660 P = HUMAN:I = MOVE
43 2670 FOR J = 1 TO 4
7A 2680 GOSUB 2040
E8 2690 IF K >= 4 THEN GAME$ = "HUMAN":J = 4
B0 2700 NEXT
E4 2710 RETURN
56 2720 REM OUTCOME
4B 2730 VTAB 22: HTAB 14: PRINT SPC( 14)
2D 2740 W$ = "WE TIE."
2F 2750 IF GAME$ = "QUIT" THEN W$ = "BOO, CAESAR, BO
    O"
E8 2760 IF GAME$ = "APPLE" THEN W$ = "I WIN !"
B3 2770 IF GAME$ = "HUMAN" THEN W$ = "YOU WIN, CAESA
    R."
B4 2780 VTAB 22: HTAB 22 - LEN (W$) / 2: INVERSE : P
    RINT W$;: NORMAL
BA 2790 FOR I = 1 TO 10: PRINT BELL$;: NEXT
E2 2800 RETURN
```


FALSTAFF

You're pitted against the Apple in this version of what's been called one of the most entertaining games of logic ever invented. Your marker is the diamond, and the Apple's is, appropriately enough, an apple. The object of each side is to have more pieces on the board at the end of the game than the opponent.

Either side goes first. To move, place a diamond on any vacant square (light or dark) so that a string of apples is sandwiched between two of your markers. The apples will turn into diamonds (Figure 2-6).

Note that each move *must* be a capture, and that captures in any direction are allowed as long as you're on a straight line. Press the Escape key if no such move is available when it's your turn. If the Apple can't move either, the game ends.

What makes Falstaff so exciting is that fortunes can change radically in just one move. You might be enjoying a four-point advantage during most of the game, for example, then the Apple captures five of your pieces. Not only does your count go down by five, but the computer's goes up by the same amount, for a total swing in score of ten points. This can be disastrous if only a couple of moves remain.

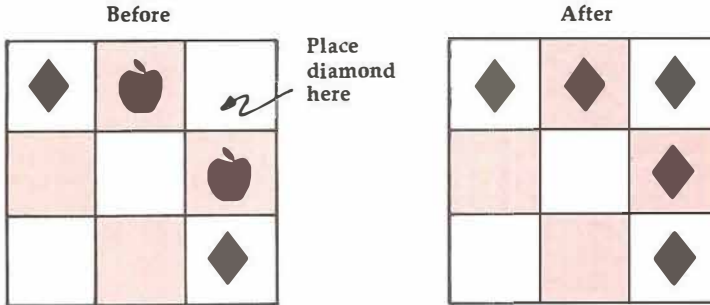
The Apple plays well and aggressively. It uses about 30 seconds to search the board for a good move, and you'll have to think ahead to beat it.

Three versions of the game are available: short, medium, and long. These lengths correspond to the maximum number of total moves allowed both sides (25, 40, or 60 moves). In the long game, the entire board will eventually fill up with apples and diamonds, assuming, of course, that you and the computer never reach the point where neither can move.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-7A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-7B. You don't have to run Program 2-7A again.

GAMES OF SKILL

Figure 2-6. Capturing Apples



Program 2-7A. Falstaff Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

6B 100 REM SHAPES FOR FALSTAFF
7C 110 REM DIRECTORY
15 120 DATA 19,0,40,0,134,0,184,0,117,1,126,1,138,1,
    151,1,162,1,175,1
C6 130 DATA 188,1,199,1,213,1,226,1,239,1,251,1,7,2,
    19,2,29,2,40,2
E4 140 REM APPLE
69 150 DATA 36,36,36,44,17,53,45,53,53,55,55,54,46,4
    6,62,62,62,36,37,39
50 160 DATA 36,36,44,60,63,60,54,45,54,54,54,54,54,3
    9,36,36,36,36,55,54
A8 170 DATA 54,54,62,36,36,60,36,36,36,39,55,46,54,5
    4,54,53,54,62,62,36
7E 180 DATA 37,60,36,36,36,39,60,54,46,54,54,54,61,5
    4,39,36,36,36,39,36
D8 190 DATA 52,55,54,46,54,54,38,39,36,55,36,36,4,0
F8 200 REM DIAMOND
36 210 DATA 44,54,63,36,44,45,54,54,63,63,36,36,36,1
    2,54,37,36,21,54,37
D7 220 DATA 21,46,21,63,46,45,30,63,46,30,55,30,36,5
    5,54,7,32,60,62,32
B4 230 DATA 36,36,60,50,54,62,32,60,50,0
FE 240 REM CHECKERED PATTERN
69 250 DATA 9,9,9,9,9,18,18,18,18,31,31,31,31,31,31,
    31,31,31,31,12
44 260 DATA 13,13,13,13,13,13,13,13,13,5,56,59,59,59
    ,59,59,59,59,59
C2 270 DATA 35,41,41,41,41,41,41,41,41,41,56,59,5
    9,59,59,59,59,59,59
  
```

GAMES OF SKILL

```

AA 280 DATA 59,35,41,41,41,41,41,41,41,41,41,41,56,5
9,59,59,59,59,59
DB 290 DATA 59,59,35,41,41,41,41,41,41,41,41,41,5
6,59,59,59,59,59,59
44 300 DATA 59,59,59,35,41,41,41,41,41,41,41,41,4
1,56,59,59,59,59,59
12 310 DATA 59,59,59,59,35,41,41,41,41,41,41,41,4
1,41,56,59,59,59,59
72 320 DATA 59,59,59,59,59,35,41,41,41,41,41,41,4
1,41,41,56,59,59,59
67 330 DATA 59,59,59,59,59,59,35,41,41,41,41,41,4
1,41,41,41,56,59,59
E4 340 DATA 59,59,59,59,59,59,59,35,0
F7 350 REM DIGITS 1 TO 8
54 360 DATA 36,60,42,54,54,46,63,7,0
26 370 DATA 45,32,28,63,23,22,17,23,46,45,37,0
BF 380 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
16 390 DATA 33,36,23,23,23,46,45,61,54,6,0
7A 400 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
C0 410 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
49 420 DATA 30,54,36,5,40,40,32,63,63,7,0
F0 430 DATA 45,50,30,63,7,32,12,28,36,41,45,50,6,0
2B 440 REM LETTERS A TO H
21 450 DATA 58,55,38,36,36,33,41,42,50,62,53,54,0
87 460 DATA 63,36,44,45,21,54,43,50,30,63,39,36,0
58 470 DATA 1,8,32,59,63,50,54,54,41,45,32,0
40 480 DATA 9,54,30,63,39,36,36,44,45,21,54,0
A6 490 DATA 47,37,8,56,63,55,54,54,46,45,45,0
EF 500 DATA 61,63,54,38,36,36,44,45,53,0
B0 510 DATA 10,53,62,63,28,36,36,12,45,45,0
DB 520 DATA 45,36,60,27,51,54,61,54,46,9,33,36,0
E7 530 FOR I = 16384 TO 16948
A9 540 READ V
91 550 POKE I,V
09 560 NEXT
12 570 PRINT CHR$(4); "BSAVE FS.SHAPE,A16384,L565"
9D 580 END

```

Program 2-7B. Falstaff

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

EE 100 LOMEM: 17000
32 110 REM FALSTAFF
A8 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
49 150 GOSUB 800
EC 160 REM PLAY AGAIN
10 170 VTAB 24: HTAB 13: PRINT "PLAY AGAIN (Y/N) ? "
;BELL$;

```

GAMES OF SKILL

```
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
2B 240 REM TITLE
4B 250 GOSUB 330
8B 260 REM INSTRUCTIONS
5B 270 GOSUB 390
5B 280 REM VALUES
5D 290 GOSUB 570
F6 300 REM SHAPES
4A 310 GOSUB 740
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$(21): TEXT : HOME
AB 350 VTAB 12: HTAB 16: PRINT "FALSTAFF"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$(7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
87 410 PRINT "I'M THE APPLE, AND YOU'RE THE DIAMOND.
": PRINT
F2 420 PRINT "TO MOVE, PLACE A DIAMOND ON AN EMPTY"
8A 430 PRINT "SQUARE SO THAT A STRING OF MY PIECES"
E5 440 PRINT "IS SANDWICHED BETWEEN TWO OF YOURS.":
PRINT
C0 450 PRINT " - MY APPLES WILL BECOME YOUR DIAMONDS
.": PRINT.
22 460 PRINT " - PRESS ";: INVERSE : PRINT "ESC";: N
ORMAL : PRINT "APE IF YOU CAN'T MOVE."
EE 470 VTAB 12: HTAB 1: PRINT "THE GAME ENDS WHEN NE
ITHER SIDE CAN GO."
6D 480 VTAB 15: HTAB 1: PRINT "ARE YOU USING A COLOR
MONITOR (Y/N) ? ";BELL$;
67 490 GET S$
7E 500 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
ND S$ < > "n" THEN 480
8B 510 K(1) = 3:K(2) = 3
1E 520 IF S$ = "Y" OR S$ = "y" THEN K(1) = 5:K(2) =
6
93 530 HOME : VTAB 12: HTAB 6: INVERSE : PRINT "N/L"
": NORMAL : PRINT " STANDS FOR NUMBER/LETTER.
"
65 540 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
60 550 GET S$
21 560 RETURN
59 570 REM VALUES
```

GAMES OF SKILL

```
FE 580 DIM B(10,10)
C4 590 : REM DIRECTION DELTAS
2C 600 K = 8
63 610 DATA 0,1, -1,1, -1,0, -1,-1, 0,-1, 1,-1, 1,0,
    1,1
B6 620 FOR I = 1 TO K
FD 630 READ DR(I),DC(I)
06 640 NEXT
E6 650 : REM X & Y COORDINATES
01 660 DEF FN X(V) = 22 * V + 24
6D 670 DEF FN Y(V) = 18 * V - 15
3A 680 : REM LENGTH OF GAME
93 690 DATA SHORT,25,MEDIUM,40,LONG,60
F2 700 FOR I = 1 TO 3
CC 710 READ LG$(I),LG(I)
03 720 NEXT
1D 730 RETURN
03 740 REM SHAPES
54 750 HOME
25 760 VTAB 12: HTAB 17: PRINT "READING"
44 770 PRINT CHR$(4);"BLOAD FS.SHAPE"
A2 780 POKE 233,64: POKE 232,0
29 790 RETURN
99 800 REM PLAY
52 810 : REM INITIALIZE
59 820 GOSUB 970
EE 830 : REM CHOOSE SQUARE
D1 840 MOVE$ = "ON"
04 850 ON PLAYER GOSUB 1800,2480
27 860 : REM MAKE MOVE
90 870 IF MOVE$ = "OFF" THEN GOSUB 2030
48 880 IF MOVE$ = "ON" THEN GOSUB 2120
3C 890 : REM SHOW SCORE
47 900 IF MOVE$ = "ON" THEN GOSUB 2440
19 910 : REM CONTINUE
C0 920 PLAYER = 3 - PLAYER
FC 930 IF MOVES > 0 AND GAME$ = "ON" THEN 840
2F 940 : REM DISPLAY OUTCOME
E0 950 GOSUB 2800
25 960 RETURN
BA 970 REM INITIALIZE
3D 980 : REM LENGTH OF GAME
DD 990 GOSUB 1110
E5 1000 : REM FIRST PLAYER UP
4F 1010 GOSUB 1230
0E 1020 : REM BOARD
5B 1030 GOSUB 1330
9A 1040 : REM LABELS
8F 1050 GOSUB 1480
83 1060 : REM RECORD
```

GAMES OF SKILL

```
8B 1070 GOSUB 1560
4A 1080 : REM PIECES
7B 1090 GOSUB 1720
03 1100 RETURN
06 1110 REM LENGTH
62 1120 TEXT : HOME
62 1130 VTAB 10: HTAB 9: PRINT "MAXIMUM LENGTH OF GA
    ME"
9B 1140 FOR I = 1 TO 3
53 1150 VTAB I * 2 + 10: HTAB 11: INVERSE : PRINT I;
    : NORMAL : PRINT CHR$ (32);LG$(I); TAB( 20);
    "(";LG(I);" MOVES)"
8B 1160 NEXT
F2 1170 VTAB 18: HTAB 11: PRINT "=> ? ";BELL$;
76 1180 GET S$
6A 1190 V = VAL (S$)
81 1200 IF V < 1 OR V > 3 THEN 1170
63 1210 MOVES = LG(V)
DD 1220 RETURN
05 1230 REM FIRST UP
4C 1240 HOME
10 1250 VTAB 12: HTAB 8: PRINT "MAY I GO FIRST (Y/N)
    = ? ";BELL$;
70 1260 GET S$
59 1270 A = ASC (S$): IF A > 96 THEN A = A - 32
C9 1280 L$ = CHR$ (A)
CB 1290 IF L$ < > "Y" AND L$ < > "N" THEN 1250
55 1300 PLAYER = 1
B2 1310 IF L$ = "N" THEN PLAYER = 2
DF 1320 RETURN
EC 1330 REM BOARD
AB 1340 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= 3
8B 1350 : REM SQUARES
8E 1360 FOR R = 2 TO 9
0B 1370 FOR C = 2 TO 9
EB 1380 IF (R + C) / 2 = INT ((R + C) / 2) THEN DRAW
    3 AT FN X(C), FN Y(R)
34 1390 NEXT C,R
CB 1400 : REM LINES
CC 1410 FOR I = 57 TO 233 STEP 22
19 1420 HPLLOT I,13 TO I,155
B5 1430 NEXT
4F 1440 FOR I = 12 TO 156 STEP 18
5E 1450 HPLLOT 57,I TO 233,I
C1 1460 NEXT
F5 1470 RETURN
0B 1480 REM LABEL
18 1490 FOR I = 2 TO 9
AB 1500 DRAW I + 2 AT 40, FN Y(I)
A9 1510 DRAW I + 10 AT FN X(I),4
```


GAMES OF SKILL

```

B3 1520 NEXT
13 1530 VTAB 24: HTAB 10: INVERSE : PRINT "MOVES";:
    HTAB 21: PRINT "SCORE";: NORMAL
EF 1540 VTAB 24: HTAB 16: PRINT MOVES;: HTAB 27: PRI
    NT "2 TO 2";
EF 1550 RETURN
AF 1560 REM RECORD
DE 1570 : REM APPLE=1; HUMAN=2; OFF-BOARD=-9
A9 1580 FOR I = 1 TO 10
FE 1590 B(I,1) = - 9:B(I,10) = - 9
93 1600 B(1,I) = - 9:B(10,I) = - 9
B1 1610 NEXT
04 1620 FOR R = 2 TO 9
01 1630 FOR C = 2 TO 9
57 1640 B(R,C) = 0
7A 1650 NEXT C,R
65 1660 B(5,5) = 1:B(6,6) = 1
00 1670 B(5,6) = 2:B(6,5) = 2
26 1680 SCR(1) = 2:SCR(2) = 2
01 1690 GAME$ = "ON"
5B 1700 FT = 0: REM FORFEIT TURN
E3 1710 RETURN
03 1720 REM PIECES
60 1730 FOR R = 5 TO 6
DC 1740 FOR C = 5 TO 6
C5 1750 V = B(R,C):X = FN X(C):Y = FN Y(R)
33 1760 HCOLOR= 0: DRAW 3 AT X,Y
B4 1770 HCOLOR= K(V): DRAW V AT X,Y
38 1780 NEXT C,R
04 1790 RETURN
FE 1800 REM APPLE'S TURN
C9 1810 VTAB 22: HTAB 14: PRINT SPC( 14);: HTAB 17:
    PRINT "MY TURN ...";
BD 1820 HPTS = - 9:ENEMY = 2
08 1830 FOR I = 2 TO 9
0C 1840 FOR J = 2 TO 9
92 1850 IF B(I,J) = 0 THEN GOSUB 1890
15 1860 NEXT J,I
38 1870 IF HPTS = 0 THEN MOVE$ = "OFF"
02 1880 RETURN
09 1890 REM TALLY SCORE
99 1900 PTS = 0
A2 1910 FOR L = 1 TO K
8D 1920 CNT = 0:R = I:C = J
07 1930 R = R + DR(L):C = C + DC(L): IF B(R,C) = ENE
    MY THEN CNT = CNT + 1: GOTO 1930
4B 1940 IF B(R,C) = PLAYER AND CNT > 0 THEN PTS = PT
    S + CNT
94 1950 NEXT L
BD 1960 : REM ADJUST IT

```

GAMES OF SKILL

```

8B 1970 VR = ABS (I - 5.5):HZ = ABS (J - 5.5)
1E 1980 IF VR = 3.5 OR HZ = 3.5 THEN PTS = 2 * PTS
52 1990 IF VR = 2.5 OR HZ = 2.5 THEN PTS = PTS / 2
27 2000 IF PTS > HPTS THEN HPTS = PTS:RW = I:CL = J
4C 2010 IF PTS = HPTS AND RND (1) > 0.5 THEN RW = I:
    CL = J
DA 2020 RETURN
B7 2030 REM CAN'T MOVE
CA 2040 M$ = "I CAN'T MOVE"
99 2050 IF PLAYER = 2 THEN M$ = "FORFEIT TURN"
6C 2060 VTAB 22: HTAB 14: PRINT SPC( 14);: HTAB 22 -
    LEN (M$) / 2: INVERSE : PRINT M$;: NORMAL
15 2070 FOR I = 1 TO 250:SOUND = PEEK (Z): NEXT
8B 2080 FOR PAUSE = 1 TO 2500: NEXT
4D 2090 FT = FT + 1
64 2100 IF FT = 2 THEN GAME$ = "OVER"
DB 2110 RETURN
3B 2120 REM MOVE
67 2130 : REM INITIAL SQUARE
FD 2140 ENEMY = 3 - PLAYER
7B 2150 R = RW:C = CL: GOSUB 2250
EF 2160 SCR(PLAYER) = SCR(PLAYER) + 1
4B 2170 : REM OTHERS
2E 2180 FOR I = 1 TO K
EE 2190 R = RW:C = CL: CNT = 0
5C 2200 R = R + DR(I):C = C + DC(I): IF B(R,C) = ENE
    MY THEN CNT = CNT + 1: GOTO 2200
33 2210 IF B(R,C) = PLAYER AND CNT > 0 THEN GOSUB 23
    60
7B 2220 NEXT I
AD 2230 MOVES = MOVES - 1:FT = 0
E6 2240 RETURN
17 2250 REM FLASH
6D 2260 X = FN X(C):Y = FN Y(R)
C7 2270 HCOLOR= 0: DRAW 3 AT X,Y: DRAW ENEMY AT X,Y
A9 2280 KR(1) = K(PLAYER):KR(2) = 0:KR(3) = KR(1)
34 2290 FOR L = 1 TO 3
5F 2300 HCOLOR= KR(L): DRAW PLAYER AT X,Y
43 2310 SOUND = PEEK (Z)
A1 2320 FOR PAUSE = 1 TO 200: NEXT PAUSE
81 2330 NEXT L
84 2340 B(R,C) = PLAYER
EC 2350 RETURN
5E 2360 REM FLIP PIECES
2B 2370 R = RW:C = CL
41 2380 FOR J = 1 TO CNT
0B 2390 R = R + DR(I):C = C + DC(I): GOSUB 2250
75 2400 NEXT J
12 2410 SCR(PLAYER) = SCR(PLAYER) + CNT
5B 2420 SCR(ENEMY) = SCR(ENEMY) - CNT

```

GAMES OF SKILL

```
E6 2430 RETURN
E8 2440 REM SHOW SCORE
57 2450 VTAB 24: HTAB 16: PRINT MOVES; SPC( 1);
42 2460 VTAB 24: HTAB 27: PRINT SPC( 8);: HTAB 27: P
    RINT SCR(1);" TO ";SCR(2);
F6 2470 RETURN
B6 2480 REM HUMAN'S TURN
B9 2490 COL(1) = 25:COL(2) = 27
C6 2500 NORMAL : VTAB 22: HTAB 14: PRINT "YOUR TURN:
    ";: INVERSE : PRINT "N/L"
D4 2510 : REM GET NUMBER & LETTER
8C 2520 FOR I = 1 TO 2
74 2530 GOSUB 2630
8C 2540 NEXT
7F 2550 IF MOVE$ = "OFF" THEN 2610
D9 2560 : REM CHECK LEGALITY
47 2570 IF B(RW,CL) < > 0 THEN PRINT BELL$;: GOTO 25
    20
8C 2580 : REM CHECK FOR CAPTURE
88 2590 GOSUB 2720
D2 2600 IF CAP$ = "NO" THEN PRINT BELL$;: GOTO 2520
4A 2610 NORMAL
E6 2620 RETURN
21 2630 REM GET
A8 2640 VTAB 22: HTAB COL(I)
62 2650 GET S$:A = ASC (S$): IF A > 96 THEN A = A -
    32
66 2660 IF A = 27 THEN MOVE$ = "OFF":I = 2: GOTO 271
    0
F1 2670 IF I = 1 THEN V = A - 48:RW = V + 1
98 2680 IF I = 2 THEN V = A - 64:CL = V + 1
4B 2690 IF V < 1 OR V > 8 THEN PRINT BELL$;: GOTO 26
    40
66 2700 PRINT CHR$ (A)
E4 2710 RETURN
B7 2720 REM CHECK FOR CAPTURE
58 2730 CAP$ = "NO"
2A 2740 FOR I = 1 TO K
39 2750 CNT = 0:R = RW:C = CL
24 2760 R = R + DR(I):C = C + DC(I): IF B(R,C) = 1 T
    HEN CNT = CNT + 1: GOTO 2760
55 2770 IF B(R,C) = PLAYER AND CNT > 0 THEN CAP$ = "
    YES":I = K
D0 2780 NEXT
05 2790 RETURN
50 2800 REM OUTCOME
34 2810 VTAB 22: HTAB 14: PRINT SPC( 14);
```

GAMES OF SKILL

```
8A 2820 IF SCR(1) > SCR(2) THEN VTAB 22: HTAB 14: PR
    INT "I WIN: ";: INVERSE : PRINT SCR(1);: NOR
    MAL : PRINT " TO ";: INVERSE : PRINT SCR(2);
    : NORMAL : PRINT " !";
FF 2830 IF SCR(2) > SCR(1) THEN VTAB 22: HTAB 9: PRI
    NT "YOU WIN: ";: INVERSE : PRINT SCR(2);: NO
    RMAL : PRINT " TO ";: INVERSE : PRINT SCR(1)
    ;: NORMAL : PRINT " ... SIGH";
FF 2840 IF SCR(1) = SCR(2) THEN VTAB 22: HTAB 13: PR
    INT "TIE GAME: ";: INVERSE : PRINT SCR(1);:
    NORMAL : PRINT " TO ";: INVERSE : PRINT SCR(
    2);: NORMAL
AC 2850 FOR I = 1 TO 10: PRINT BELL$;: NEXT
60 2860 VTAB 24: HTAB 10: PRINT SPC( 25);
FE 2870 RETURN
```

MEMORY MATE

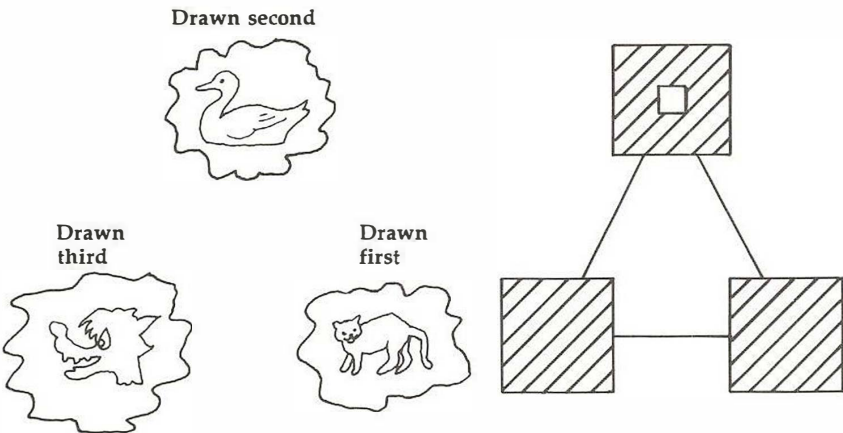
The Apple draws violins, knights, bunnies, and other items on the screen in this intriguing game of recall. It quickly covers each object as it goes along, and your job is to try to remember where each one is and the order in which it was drawn.

Six levels of difficulty are available: 3, 4, 5, 6, 7, and 8. Each level corresponds to the number of items displayed. In the easiest version (3), a duck, a fox, and a cat are drawn on the screen, and they form a triangle. At the higher levels, the objects form a box, a pentagon, a pyramid, a V, and finally a circle.

To learn how to play Memory Mate, start with a triangle. This is the easiest game, and a good place to learn the rules.

For the sake of illustration, suppose the Apple draws a cat, a duck, and a fox on the screen in that order, and in the locations in Figure 2-7. After covering up all the creatures, the Apple positions the cursor at the top of the triangle.

Figure 2-7. Memory Mate



Move the cursor by using the space bar. Press it six times, and you'll see the cursor fly from one box of the triangle to another. But where do you want it to stop? The rightmost box is the correct answer since an object was drawn there first.

Now hit C for cat. This is because the Apple drew the cat before any other creature. Next, move the cursor to the highest box of the triangle and hit D for duck. Then hit F for fox in the remaining square.

That wasn't too bad, was it? But then again, this was the easiest game. Try the pentagon, and you'll have five objects and five positions to remember, or ten pieces of information in all.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-8A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-8B. You don't have to run Program 2-8A again.

Program 2-8A. Memory Mate Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
20 100 REM SHAPE DATA FOR MEMORY MATE
7C 110 REM DIRECTORY
C3 120 DATA 12,0,26,0,106,0,216,0,87,1,199,1,249,1,1
    45,2,254,2,148,3
E9 130 DATA 199,3,213,3,223,3
02 140 REM DUCK
2F 150 DATA 39,60,44,44,50,46,62,62,46,54,45,46,45,4
    4,37,45,21,46,46,61
B0 160 DATA 39,63,62,60,63,62,55,39,23,23,39,44,39,3
    9,60,36,60,36,61,36
A5 170 DATA 39,60,60,52,54,53,47,46,54,54,53,54,53,4
    6,54,39,55,39,60,62
3A 180 DATA 36,61,55,62,60,39,63,45,45,37,44,45,38,6
    0,39,37,47,36,4,0
07 190 REM FOX
B9 200 DATA 37,36,36,63,62,39,33,63,38,12,45,46,44,4
    6,44,42,53,45,37,45
78 210 DATA 44,61,62,62,62,63,63,60,55,53,61,55,53,4
    5,44,46,44,52,46,46
51 220 DATA 45,55,63,39,63,63,63,52,46,45,45,46,63,5
    1,14,46,62,46,63,39
8D 230 DATA 36,39,44,63,54,46,54,63,37,36,60,55,63,6
    2,63,55,63,39,39,39
3B 240 DATA 39,37,63,32,12,53,54,53,46,36,21,46,44,5
    4,55,45,36,44,54,37
87 250 DATA 44,46,44,37,63,47,36,35,36,0
36 260 REM CAT
3F 270 DATA 45,46,54,62,54,55,63,31,35,36,44,36,45,3
    6,45,45,46,54,54,30
```


GAMES OF SKILL

- 4A 280 DATA 21,45,32,37,39,61,60,44,44,44,44,45,46,5
4,54,23,23,45,32,37
- B9 290 DATA 36,39,39,39,63,55,36,61,60,38,39,55,54,5
3,62,38,39,61,36,36
- 91 300 DATA 60,54,54,54,39,36,36,60,54,54,54,39,36,3
6,60,50,54,54,54,39
- BD 310 DATA 36,36,60,50,54,54,54,55,54,22,31,47,36,4
4,36,44,36,36,60,60
- BF 320 DATA 60,52,63,63,43,42,45,53,53,53,54,55,54,5
5,36,39,37,39,45,60
- AA 330 DATA 60,39,31,46,54,45,0
- E6 340 REM WITCH
- 24 350 DATA 32,39,44,36,45,38,61,36,61,39,63,52,53,4
6,63,23,46,53,14,14
- 50 360 DATA 53,45,45,12,37,41,12,30,55,26,19,27,59,2
3,55,46,62,54,55,55
- F1 370 DATA 55,60,55,60,63,37,45,37,31,12,13,38,37,3
9,13,60,63,62,62,55
- 3F 380 DATA 51,59,30,54,55,63,36,37,37,9,37,33,40,37
,37,61,31,62,37,44
- 02 390 DATA 37,45,41,37,31,63,36,39,56,62,60,58,62,6
0,50,61,39,23,55,45
- 0C 400 DATA 46,38,45,32,41,45,62,55,61,55,6,0
- 29 410 REM VIOLIN
- 4B 420 DATA 41,53,55,39,55,62,52,55,47,53,55,61,54,5
9,63,44,44,61,63,55
- 22 430 DATA 60,44,37,31,44,40,38,44,46,38,37,47,44,3
8,37,39,37,45,62,46
- FE 440 DATA 41,28,12,12,12,12,12,44,54,0
- 0D 450 REM KNIGHT
- 1A 460 DATA 36,36,36,44,60,36,37,63,55,47,53,63,46,5
3,63,46,53,63,55,45
- 7B 470 DATA 49,63,59,52,63,63,47,45,45,46,45,45,37,3
6,54,45,37,37,53,53
- 73 480 DATA 45,45,45,45,52,61,62,27,27,27,54,39,60,6
2,36,55,63,51,41,53
- 19 490 DATA 63,63,39,63,63,23,63,63,23,63,39,39,55,1
0,41,45,45,45,45,45
- 6F 500 DATA 40,46,45,45,45,58,63,63,63,59,63,63,63,6
3,47,46,45,45,45,45
- 4A 510 DATA 13,45,45,45,62,63,63,31,59,63,63,63,63,4
6,45,45,45,45,45,45
- 00 520 DATA 45,45,50,53,23,30,30,4,8,60,39,37,63,60,
63,62,63,63,60,55
- 6C 530 DATA 63,46,53,14,21,31,58,32,35,55,6,0
- E8 540 REM APPLE
- BA 550 DATA 36,36,37,36,37,53,18,53,45,53,53,46,54,5
4,39,36,60,60,60,55
- 61 560 DATA 46,54,54,14,37,53,62,62,60,54,61,55,36,3
6,36,36,39,36,60,54

GAMES OF SKILL

```
19 570 DATA 54,46,54,54,54,62,36,36,36,55,54,54,39,3
    6,36,44,36,36,60,28
74 580 DATA 54,54,54,54,54,54,62,36,36,36,36,36,36,6
    0,54,54,54,54,54,54
85 590 DATA 38,39,36,36,36,36,36,55,54,54,54,54,54,6
    0,36,36,36,36,36,62
B6 600 DATA 54,54,54,54,36,39,36,36,0
F8 610 REM BUNNY
08 620 DATA 45,44,37,47,44,37,37,36,37,44,53,44,44,3
    9,55,39,52,62,54,55
56 630 DATA 55,51,62,28,36,44,36,37,52,55,55,62,54,5
    4,62,62,36,37,63,44
28 640 DATA 36,37,60,60,52,53,54,62,63,46,50,59,39,7
    ,56,58,60,60,36,37
88 650 DATA 62,62,63,53,54,44,44,53,53,53,21,53,37,5
    3,53,45,62,63,60,22
FD 660 DATA 9,45,45,37,54,53,63,60,63,55,45,53,45,53
    ,42,46,53,53,42,45
31 670 DATA 46,55,39,55,39,55,63,60,44,37,37,63,62,3
    9,37,39,60,54,54,7
52 680 DATA 32,36,7,56,22,53,62,56,36,39,23,46,54,53
    ,54,55,63,44,36,55
CD 690 DATA 39,39,60,36,53,53,46,44,5,0
51 700 REM 11x9 BOX
25 710 DATA 44,54,63,36,44,45,54,54,63,63,36,36,44,4
    5,45,54,54,54,63,63
75 720 DATA 63,36,36,36,44,45,45,45,54,54,54,54,62,6
    0,62,60,62,60,62,60
29 730 DATA 38,36,36,36,36,44,45,45,45,45,0
BC 740 REM CURSOR
20 750 DATA 4,40,49,51,49,58,56,58,32,32,51,50,42,0
67 760 REM RIGHT BAR
63 770 DATA 45,45,45,45,45,45,45,45,45,0
65 780 REM LEFT BAR
66 790 DATA 63,63,63,63,63,63,63,63,63,0
C9 800 FOR I = 16384 TO 17384
A6 810 READ V
9E 820 POKE I,V
06 830 NEXT
0D 840 PRINT CHR$(4);"BSAVE MM.SHAPE,A16384,L1001"
9A 850 END
```

Program 2-8B. Memory Mate

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
17 100 LOMEM: 17500
8F 110 REM MEMORY MATE
A8 120 REM INITIALIZE
45 130 GOSUB 230
```

GAMES OF SKILL

```
50 140 REM PLAY GAME
4F 150 GOSUB 830
EC 160 REM PLAY AGAIN
8F 170 VTAB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
2B 240 REM TITLE
4B 250 GOSUB 330
8B 260 REM INSTRUCTIONS
5B 270 GOSUB 390
5B 280 REM VALUES
53 290 GOSUB 520
F6 300 REM SHAPES
50 310 GOSUB 770
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$ (21): TEXT : HOME
06 350 VTAB 12: HTAB 15: PRINT "MEMORY MATE"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
AD 410 PRINT "I'M ABOUT TO DRAW BETWEEN 3 AND 8 ITEM
    S"
3D 420 PRINT "ON YOUR SCREEN. I'LL COVER UP EACH ONE
    "
9E 430 PRINT "AS I GO.": PRINT
3A 440 PRINT "TRY TO RECALL WHERE EACH OBJECT IS, AN
    D"
25 450 PRINT "THE ORDER IN WHICH I DREW IT."
33 460 VTAB 9: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
63 470 GET S$
8C 480 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 460
2C 490 K1 = 3:K2 = 3
84 500 IF S$ = "Y" OR S$ = "y" THEN K1 = 5:K2 = 6
17 510 RETURN
4F 520 REM VALUES
E1 530 : REM X & Y COORDINATES
05 540 DATA 140,50,100,100,180,100
E0 550 DATA 175,50,105,50,105,100,175,100
81 560 DATA 140,40,85,80,110,120,170,120,175,80
8C 570 DATA 140,30,105,75,175,75,70,120,140,120,210,
    120
```

GAMES OF SKILL

```
10 580 DATA 50,26,80,58,110,90,140,122,170,90,200,58
    ,230,26
75 590 DATA 140,21,87,35,66,80,87,124,140,138,193,12
    4,214,80,193,35
10 600 FOR I = 3 TO 8
E4 610 FOR J = 1 TO I
C6 620 READ XC(I,J),YC(I,J)
A9 630 NEXT J,I
4F 640 : REM OBJECTS
E0 650 DATA DUCK,FOX,CAT,WITCH,VIOLIN,KNIGHT,APPLE,B
    UNNY
26 660 FOR I = 1 TO 8
4F 670 READ NM$(I)
0E 680 NEXT
00 690 NM$(7) = NM$(7) + CHR$(32) + CHR$(32)
46 700 TIME = 2000: REM TIME TO VIEW SHAPE
0E 710 : REM FIGURES
D2 720 DATA TRIANGLE,BOX,PENTAGON,PYRAMID,V,CIRCLE
23 730 FOR I = 3 TO 8
A6 740 READ FIG$(I)
09 750 NEXT
23 760 RETURN
09 770 REM SHAPES
5A 780 HOME
28 790 VTAB 12: HTAB 17: PRINT "READING"
F5 800 PRINT CHR$(4); "BLOOD MM.SHAPE"
95 810 POKE 233,64: POKE 232,0
1C 820 RETURN
0B 830 REM GAME
A5 840 : REM DIFFICULTY
57 850 GOSUB 930
52 860 : REM APPLE'S TURN
E2 870 GOSUB 1040
F4 880 : REM HUMAN'S TURN
E6 890 GOSUB 1610
04 900 : REM VICTORY
6E 910 IF GAME$ = "ON" THEN GOSUB 2300
1D 920 RETURN
59 930 REM DIFFICULTY
64 940 TEXT : HOME
54 950 VTAB 4: HTAB 11: PRINT "GAME (3 = EASIEST)"
2B 960 FOR I = 3 TO 8
00 970 VTAB 2 * I + 1: HTAB 15: INVERSE : PRINT I;:
    NORMAL : PRINT CHR$(32);FIG$(I)
11 980 NEXT
A4 990 VTAB 20: HTAB 14: PRINT "=> ";BELL$;
54 1000 GET S$
97 1010 K = VAL (S$)
E6 1020 IF K < 3 OR K > 8 THEN 990
DD 1030 RETURN
```

GAMES OF SKILL

```

FE 1040 REM APPLE'S TURN
FB 1050 HOME : VTAB 8: HTAB 14: PRINT "FIGURE: ";: I
    NVERSE : PRINT FIG$(K)
A5 1060 : REM GET X&Y COORDINATES
63 1070 GOSUB 1130
28 1080 : REM GET NAMES
87 1090 GOSUB 1260
EB 1100 : REM DRAW
85 1110 GOSUB 1390
DB 1120 RETURN
44 1130 REM COORDINATES
9D 1140 : REM RANDOM DIGITS
A2 1150 FOR I = 1 TO K:SQ(I) = 0: NEXT
25 1160 FOR I = 1 TO K
4F 1170 V = INT (K * RND (1) + 1): IF SQ(V) < > 0 TH
    EN 1170
D6 1180 SQ(V) = I
C7 1190 NEXT
3R 1200 : REM SHUFFLE X&Y VALUES
13 1210 FOR I = 1 TO K
75 1220 X(I) = XC(K,SQ(I))
8B 1230 Y(I) = YC(K,SQ(I))
B5 1240 NEXT
E9 1250 RETURN
4B 1260 REM NAMES
AB 1270 : REM RANDOM DIGITS
61 1280 FOR I = 1 TO K:R(I) = 0: NEXT
33 1290 FOR I = 1 TO K
42 1300 V = INT (K * RND (1) + 1): IF R(V) < > 0 THE
    N 1300
83 1310 R(V) = I
AF 1320 NEXT
A6 1330 : REM ASCII VALUES OF FIRST LETTERS
21 1340 FOR I = 1 TO K
21 1350 N$ = NM$(R(I))
AD 1360 LTR(I) = ASC ( LEFT$ (N$,1))
C3 1370 NEXT
F7 1380 RETURN
F6 1390 REM DRAW
FE 1400 VTAB 12: HTAB 7: PRINT "<SPACE BAR>";: NORMA
    L : PRINT " MOVES THE CURSOR"
02 1410 VTAB 14: HTAB 7: PRINT "& FIRST LETTER GETS
    AN OBJECT"
86 1420 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY"
BR 1430 R = RND (1): IF PEEK ( - 16384) < 128 THEN 1
    430
DF 1440 POKE - 16368,0
0F 1450 HOME : HGR : ROT= 0: SCALE= 1
A3 1460 : REM SHAPES
2F 1470 FOR I = 1 TO K

```

GAMES OF SKILL

```
6F 1480 GOSUB 1510
97 1490 NEXT I
DB 1500 RETURN
A7 1510 REM SHAPES
E3 1520 X = X(I):Y = Y(I)
1F 1530 : REM SHAPE
F4 1540 HCOLOR= K1: DRAW R(I) AT X,Y
6A 1550 FOR PAUSE = 1 TO TIME: NEXT PAUSE
A1 1560 : REM BOX
3B 1570 FOR J = Y - 12 TO Y + 12
7D 1580 HCOLOR= K2: DRAW 11 AT X,J: DRAW 12 AT X,J
9A 1590 NEXT J
DD 1600 RETURN
9D 1610 REM HUMAN'S TURN
DF 1620 FOR I = 1 TO K:BX(I) = 0: NEXT
8E 1630 : REM DISPLAY WORDS
73 1640 GOSUB 1720
2B 1650 FOR I = 1 TO K
75 1660 : REM SELECT
F6 1670 IF GAME$ = "ON" THEN GOSUB 1790
74 1680 : REM EVALUATE
D4 1690 IF GAME$ = "ON" THEN GOSUB 2070
79 1700 NEXT I
E3 1710 RETURN
DD 1720 REM WORDS
A5 1730 VTAB 21: HTAB 1
29 1740 FOR I = 1 TO K
FB 1750 INVERSE : PRINT LEFT$ (NM$(I),1);: NORMAL :
      PRINT MID$ (NM$(I),2); SPC( 1);
C7 1760 NEXT
FA 1770 GAME$ = "ON"
FF 1780 RETURN
B2 1790 REM SELECT
3C 1800 VTAB 24: HTAB 16: NORMAL : PRINT "OBJECT# ";
      : INVERSE : PRINT I;: NORMAL
DF 1810 H = 0
4C 1820 H = H + 1: IF H = K + 1 THEN H = 1
92 1830 IF BX(H) = - 9 THEN 1820: REM OBJECT IDENTIF
      IED
43 1840 X = XC(K,H):Y = YC(K,H): HCOLOR= 0: DRAW 9 A
      T X,Y
DB 1850 : REM GET ENTRY
87 1860 GOSUB 1920
BC 1870 IF A = 32 THEN CLICK = PEEK (Z): HCOLOR= K2:
      DRAW 9 AT X,Y: GOTO 1820
E6 1880 : REM CHECK LEGALITY
69 1890 GOSUB 2010
54 1900 IF M$ = "ILLEGAL" THEN PRINT BELL$;: GOTO 18
      60
E7 1910 RETURN
```


GAMES OF SKILL

```
44 1920 REM ENTRY
89 1930 FOR J = 3 TO 0 STEP - 3
96 1940 HCOLOR= J: DRAW 10 AT X,Y
14 1950 FOR PAUSE = 1 TO 10:P = PEEK ( - 16384): NEX
    T PAUSE
96 1960 NEXT J
E7 1970 IF P < 128 THEN 1930
F9 1980 POKE - 16368,0
4D 1990 A = P - 128: IF A > 96 THEN A = A - 32
D2 2000 RETURN
90 2010 REM LEGALITY
94 2020 M$ = "ILLEGAL"
98 2030 FOR J = 1 TO K
A7 2040 IF A = LTR(J) THEN M$ = "LEGAL":J = K
81 2050 NEXT J
EA 2060 RETURN
19 2070 REM EVALUATE
FD 2080 IF NOT (A = LTR(I) AND H = SQ(I)) THEN GAME$
    = "OVER": GOSUB 2110
AE 2090 IF GAME$ = "ON" THEN BX(H) = - 9: GOSUB 2210
D4 2100 RETURN
D5 2110 REM WRONG ANSWER
9A 2120 VTAB 24: HTAB 15: PRINT SPC( 15);: HTAB 17:
    FLASH : PRINT "WRONG";: NORMAL
BF 2130 FOR J = 1 TO 200:CLICK = PEEK (Z): NEXT J: F
    OR J = 1 TO 1000: NEXT J
B1 2140 VTAB 24: HTAB 9: PRINT "VIEW OBJECT# ";I;" (
    Y/N) ? ";BELL$;
4C 2150 GET S$:V = ASC (S$): IF V > 96 THEN V = V -
    32
12 2160 L$ = CHR$ (V)
9A 2170 IF L$ < > "Y" AND L$ < > "N" THEN 2140
F1 2180 IF L$ = "Y" THEN X = XC(K,SQ(I)):Y = YC(K,SQ
    (I)): GOSUB 2210
1F 2190 VTAB 24: HTAB 9: PRINT SPC( 22);
D6 2200 RETURN
02 2210 REM DRAW OBJECT
8C 2220 : REM BOX
BD 2230 HCOLOR= 0
27 2240 FOR J = Y - 12 TO Y + 12
47 2250 DRAW 11 AT X,J: DRAW 12 AT X,J
89 2260 NEXT J
60 2270 : REM OBJECT
FF 2280 HCOLOR= K1: DRAW R(I) AT X,Y
FA 2290 RETURN
B2 2300 REM VICTORY
A9 2310 VTAB 21: HTAB 1: PRINT SPC( 46)
1D 2320 VTAB 21: HTAB 13: INVERSE : PRINT "CONGRATUL
    ATIONS!";: NORMAL
9A 2330 FOR I = 1 TO 10: PRINT BELL$;: NEXT
EB 2340 RETURN
```

THE WITCHING HOUR

The Witching Hour is an enchanting two-player game of skill and foresight, perfect entertainment for a bleak and stormy night with the wind howling, rain slashing, and windows rattling. The contest takes place on a 5×5 board with 12 wicked witches opposing 12 crafty cats in a *fright* to the finish.

Witches and cats move in any direction along the vertical, horizontal, and diagonal lines connecting the squares. Movements not along these lines are taboo. In Figure 2-8, the witch in square A can move along the diagonal line to square G. But the cat in square B can't move directly to square F because the two boxes aren't connected.

To move a witch or cat, first key in the letter of the square on which it is located. Then enter the square where you want the piece moved. The letters remain stationary for the entire game while the pieces change location.

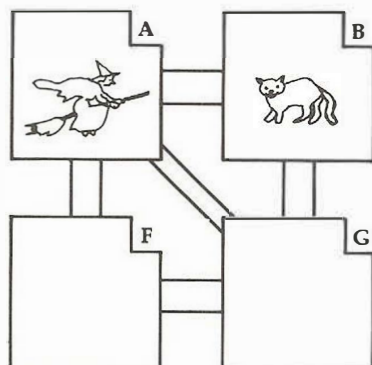
Witches and cats are allowed to move only one square at a time unless they're jumping. Just as in the game of checkers, jumps occur when one piece hops over another onto a vacant square. Double jumps are allowed. Just hit the Escape key before completing your move. The Apple will respond with the message DOUBLE JUMP to acknowledge your intention.

If you decide to play a piece and then change your mind, don't fret. Simply attempt to move to an illegal, though empty, square. The Apple will wave a naughty finger at you, but you'll get to select another.

Finally, the Witching Hour ends in victory when all of a player's pieces are captured or in a stalemate when it's a player's turn to move, but all pieces are blocked.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-9A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-9B. You don't have to run Program 2-9A again.

Figure 2-8. Moving Pieces



Program 2-9A. Witching Hour Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

BE 100 REM SHAPE DATA FOR WITCHING HOUR
7C 110 REM DIRECTORY
B4 120 DATA 32,0,66,0,178,0,49,1,141,1,245,1,54,2,24
    1,2,18,3,29,3
E9 130 DATA 40,3,49,3,60,3,72,3,82,3,94,3,105,3,114,
    3,123,3,136,3
7E 140 DATA 145,3,157,3,167,3,179,3,191,3,201,3,209,
    3,220,3,231,3,241,3
BC 150 DATA 250,3,6,4,19,4
76 160 REM WITCH 1
26 170 DATA 32,39,44,36,45,38,61,36,61,39,63,52,53,4
    6,63,23,46,53,14,14
52 180 DATA 53,45,45,12,37,41,12,30,55,26,19,27,59,2
    3,55,46,62,54,55,55
F3 190 DATA 55,60,55,60,63,37,45,37,31,12,13,38,37,3
    9,13,60,63,62,62,55
2E 200 DATA 51,59,30,54,55,63,36,37,37,9,37,33,40,37
    ,37,61,31,62,37,44
F0 210 DATA 37,45,41,37,31,63,36,39,56,62,60,58,62,6
    0,50,61,39,23,55,45
0E 220 DATA 46,38,45,32,41,45,62,55,61,55,6,0
93 230 REM CAT 1
39 240 DATA 45,46,54,62,54,55,63,31,35,36,44,36,45,3
    6,45,45,46,54,54,30
44 250 DATA 21,45,32,37,39,61,60,44,44,44,44,45,46,5
    4,54,23,23,45,32,37
B3 260 DATA 36,39,39,39,63,55,36,61,60,38,39,55,54,5
    3,62,38,39,61,36,36
    
```

GAMES OF SKILL

```

9E 270 DATA 60,54,54,54,39,36,36,60,54,54,54,39,36,3
    6,60,50,54,54,54,39
CA 280 DATA 36,36,60,50,54,54,54,55,54,22,31,47,36,4
    4,36,44,36,36,60,60
CC 290 DATA 60,52,63,63,43,42,45,53,53,53,54,55,54,5
    5,36,39,37,39,45,60
AA 300 DATA 60,39,31,46,54,45,0
76 310 REM WITCH 2
57 320 DATA 44,45,36,45,61,38,36,61,39,63,52,53,62,4
    5,62,31,35,28,28,63
C9 330 DATA 39,63,58,60,60,53,46,54,46,36,53,45,52,4
    5,21,46,41,54,53,49
9A 340 DATA 49,45,45,45,61,63,63,55,60,63,60,32,63,3
    9,55,54,53,45,61,55
98 350 DATA 54,55,55,63,38,63,44,37,37,37,36,63,36,6
    1,62,46,54,30,55,39
95 360 DATA 27,27,47,44,60,35,40,46,46,45,45,0
9E 370 REM CAT 2
CD 380 DATA 37,45,44,45,45,45,37,37,36,60,7,40,21,46
    ,54,62,62,62,54,46
70 390 DATA 46,55,54,62,47,36,36,39,36,60,54,54,46,3
    8,39,39,36,60,54,39
9F 400 DATA 60,54,46,54,61,39,39,36,55,54,46,55,39,3
    6,60,54,54,39,36,36
55 410 DATA 55,54,54,39,36,36,55,54,54,39,36,36,55,5
    4,54,46,55,39,36,36
EA 420 DATA 36,39,39,62,46,46,54,22,54,62,63,45,36,6
    0,63,47,4,8,45,60
17 430 DATA 63,37,36,0
98 440 REM 25x33 BORDER
57 450 DATA 9,9,9,9,9,9,9,9,9,9,54,54,54,54,54,54,63,63,
    63,63,63,63
79 460 DATA 63,63,63,63,63,63,63,63,63,63,36,36,36,3
    6,36,36,36,36,36,36
C6 470 DATA 36,36,45,45,45,45,45,45,45,45,45,45,45,4
    5,45,45,45,45,54,54
F7 480 DATA 54,54,54,54,0
38 490 REM 12x31 BLOCK
88 500 DATA 45,45,45,45,45,45,45,53,54,54,54,54,54,6
    3,63,63,63,63,63,63
57 510 DATA 63,63,63,63,63,63,63,63,44,45,45,45,45,4
    5,45,45,45,45,45
54 520 DATA 45,45,45,60,63,63,63,63,63,63,63,63,63,6
    3,63,63,63,63,44,45
EA 530 DATA 45,45,45,45,45,45,45,45,45,45,45,45,45,6
    0,63,63,63,63,63,63
5D 540 DATA 63,63,63,63,63,63,63,63,44,45,45,45,45,4
    5,45,45,45,45,45
5A 550 DATA 45,45,45,60,63,63,63,63,63,63,63,63,63,6
    3,63,63,63,63,44,45

```

GAMES OF SKILL

```
F0 560 DATA 45,45,45,45,45,45,45,45,45,45,45,45,45,6
    0,63,63,63,63,63,63
63 570 DATA 63,63,63,63,63,63,63,63,44,45,45,45,45,4
    5,45,45,45,45,45
60 580 DATA 45,45,45,60,63,63,63,63,63,63,63,63,6
    3,63,63,63,63,44,45
C7 590 DATA 45,45,45,45,45,45,0
17 600 REM 9x7 BLOCK
DD 610 DATA 44,54,63,36,44,45,54,54,63,63,36,36,44,4
    5,45,54,54,54,62,60
62 620 DATA 62,60,62,60,38,36,36,36,44,45,45,45,0
00 630 REM LETTERS
4E 640 DATA 3,40,45,50,54,63,63,32,41,45,0
BF 650 DATA 40,21,54,30,63,39,36,44,39,36,0
10 660 DATA 40,61,63,23,54,14,45,37,0
E0 670 DATA 56,23,54,14,45,37,36,60,37,60,0
FF 680 DATA 40,21,62,63,39,12,23,54,14,45,37,0
17 690 DATA 37,8,28,63,50,62,53,54,5,0
FB 700 DATA 58,28,36,41,45,50,62,53,30,63,7,0
D1 710 DATA 40,21,54,62,27,35,36,44,39,44,0
93 720 DATA 60,12,48,50,54,62,45,4,0
BE 730 DATA 32,8,22,54,54,30,63,32,0
AC 740 DATA 8,49,51,51,41,58,27,35,44,39,36,44,0
B6 750 DATA 36,60,53,54,54,46,63,7,0
2C 760 DATA 12,53,54,62,3,32,36,59,54,54,5,0
80 770 DATA 40,21,54,62,27,35,36,44,5,0
5F 780 DATA 40,21,54,30,63,7,32,36,41,5,6,0
BD 790 DATA 40,21,54,59,63,36,44,55,54,54,6,0
87 800 DATA 58,28,36,41,45,54,62,53,62,0
33 810 DATA 40,61,63,51,61,54,54,0
9F 820 DATA 40,61,63,23,14,45,21,30,63,63,0
C9 830 DATA 40,63,36,54,47,54,54,41,5,32,0
72 840 DATA 24,51,54,14,45,33,47,36,36,0
14 850 DATA 8,49,54,51,35,35,35,36,0
0E 860 DATA 9,52,54,62,7,32,54,59,36,36,4,0
02 870 DATA 33,57,58,35,51,41,50,41,34,59,59,42,0
B9 880 DATA 58,28,36,13,9,54,62,53,30,63,7,0
E9 890 FOR I = 16384 TO 17438
45 900 READ V
8D 910 POKE I,V
05 920 NEXT
26 930 PRINT CHR$(4); "BSAVE WH.SHAPE,A16384,L1055"
99 940 END
```


GAMES OF SKILL

Program 2-9B. Witching Hour

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
17 100 LOMEM: 17500
A8 110 REM WITCHING HOUR
A8 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
57 150 GOSUB 870
EC 160 REM PLAY AGAIN
8F 170 VTAB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
A8 230 REM INITIALIZE
2B 240 REM TITLE
4B 250 GOSUB 330
8B 260 REM INSTRUCTIONS
5B 270 GOSUB 390
5B 280 REM VALUES
55 290 GOSUB 530
F6 300 REM SHAPES
45 310 GOSUB 810
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$ (21): TEXT : HOME
A3 350 VTAB 12: HTAB 12: PRINT "THE WITCHING HOUR"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
7B 410 PRINT "TWELVE WICKED WITCHES OPPOSE TWELVE"
6B 420 PRINT "CRAFTY CATS IN THIS ENCHANTING GAME"
3F 430 PRINT "OF SORCERY.": PRINT
C9 440 PRINT "THE OBJECT OF EACH SIDE IS TO CAPTURE"
A6 450 PRINT "THE OTHER'S PIECES BY JUMPING.": PRINT
2E 460 PRINT " - PRESS "; INVERSE : PRINT "ESC";: N
    ORMAL : PRINT "APE TO DOUBLE JUMP."
67 470 VTAB 11: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
65 480 GET S$
8F 490 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 470
89 500 K(1) = 3:K(2) = 3
1C 510 IF S$ = "Y" OR S$ = "y" THEN K(1) = 5:K(2) =
    6
```


GAMES OF SKILL

```

19 520 RETURN
51 530 REM VALUES
78 540 : REM ROW & COL OF EACH LETTER (1 TO 25)
65 550 DEF FN ROW(V) = INT ((V - 1) / 5) + 1
2E 560 DEF FN COL(V) = V - 5 * INT ((V - 1) / 5)
98 570 : REM COORDINATES
FA 580 DEF FN X(V) = 43 * V + 9
4E 590 DEF FN Y(V) = 33 * V - 20
3C 600 DEF FN XL(V) = 43 * V + 22
57 610 DEF FN YL(V) = 33 * V - 28
D2 620 : REM EVEN/ODD
1A 630 DEF FN ED(V) = ( INT (V / 2) = V / 2)
91 640 : REM OUTCOMES
96 650 DATA "THE WITCHES WIN !","THE CATS WIN !"
E1 660 READ V$(1),V$(2)
5B 670 : REM DIRECTION DELTAS (E TO SE)
71 680 DATA 0,1, -1,1, -1,0, -1,-1, 0,-1, 1,-1, 1,0,
    1,1
2C 690 FOR I = 1 TO 8
BE 700 READ DROW(I),DCOL(I)
01 710 NEXT
1C 720 : REM OFF-BOARD SQUARES
98 730 DIM B(6,6)
12 740 FOR I = 0 TO 6
FD 750 B(I,0) = 9:B(I,6) = 9
87 760 B(0,I) = 9:B(6,I) = 9
00 770 NEXT
82 780 DBL$ = " DOUBLE JUMP! "
91 790 N$(1) = "FLY WITCH, FLY":N$(2) = "LEAP CAT, L
    EAP"
19 800 RETURN
FD 810 REM SHAPES
4F 820 HOME
20 830 VTAB 12: HTAB 17: PRINT "READING"
FD 840 PRINT CHR$(4):"BLOAD WH.SHAPE"
9D 850 POKE 233,64: POKE 232,0
24 860 RETURN
A7 870 REM PLAY
C1 880 : REM SET VALUES
DA 890 GOSUB 1010
87 900 : REM DRAW BOARD
C9 910 GOSUB 1100
20 920 : REM MAKE MOVE
D5 930 GOSUB 1500
C4 940 PLAYER = 3 - PLAYER
11 950 : REM CHECK FOR END
F0 960 GOSUB 2550
AA 970 IF GAME$ = "ON" THEN 930
A7 980 : REM OUTCOME
EE 990 GOSUB 2720

```

GAMES OF SKILL

```

D1 1000 RETURN
5E 1010 REM SET VALUES
B1 1020 FOR I = 1 TO 5
36 1030 FOR J = 1 TO 5
5E 1040 SQ = 5 * (I - 1) + J
D0 1050 IF SQ < = 12 THEN B(I,J) = 1: REM WITCH
87 1060 IF SQ > = 14 THEN B(I,J) = 2: REM CAT
09 1070 NEXT J,I
17 1080 B(3,3) = 0:PLAYER = 1
F5 1090 RETURN
DC 1100 REM BOARD
98 1110 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= 3
CA 1120 : REM LINES
61 1130 GOSUB 1240
83 1140 : REM SQUARES
6A 1150 FOR RW = 1 TO 5
DB 1160 FOR CL = 1 TO 5
58 1170 IF B(RW,CL) < > 0 THEN GOSUB 1420
E7 1180 NEXT CL,RW
C7 1190 : REM CENTER
1B 1200 X = FN X(3):Y = FN Y(3)
F8 1210 HCOLOR= 3: DRAW 5 AT X,Y: DRAW 6 AT X,Y: DRA
    W 6 AT X,Y - 11
9F 1220 HCOLOR= 0: DRAW 20 AT FN XL(3), FN YL(3)
E1 1230 RETURN
4C 1240 REM LINES
12 1250 : REM VERTICAL
C5 1260 FOR I = 1 TO 5
78 1270 X = FN X(I)
B8 1280 FOR J = X - 1 TO X + 1
AF 1290 HPLLOT J,13 TO J,145
F2 1300 NEXT J,I
4E 1310 : REM HORZ
B7 1320 FOR I = 1 TO 5
7B 1330 Y = FN Y(I)
EC 1340 FOR J = Y - 1 TO Y + 1
61 1350 HPLLOT 52,J TO 224,J
88 1360 NEXT J,I
F7 1370 : REM + SLANT
96 1380 HPLLOT 52,79 TO 138,13: HPLLOT 52,145 TO 224,1
    3: HPLLOT 138,145 TO 224,79
02 1390 : REM - SLANT
DA 1400 HPLLOT 52,79 TO 138,145: HPLLOT 52,13 TO 224,1
    45: HPLLOT 138,13 TO 224,79
D0 1410 RETURN
F2 1420 REM DRAW SQUARE
56 1430 X = FN X(CL):Y = FN Y(RW):XL = FN XL(CL):YL
    = FN YL(RW)
55 1440 V = B(RW,CL):SQ = 5 * (RW - 1) + CL
45 1450 HCOLOR= 3: DRAW 5 AT X,Y

```

GAMES OF SKILL

```

C5 1460 HCOLOR= 0: DRAW 6 AT X,Y: DRAW 6 AT X,Y - 11
AE 1470 HCOLOR= K(V): DRAW V AT X,Y
63 1480 HCOLOR= 3: DRAW 7 AT XL,YL: HCOLOR= 0: DRAW
    SQ + 7 AT XL,YL
FD 1490 RETURN
3A 1500 REM MOVE
16 1510 : REM ERASE LINES
7D 1520 GOSUB 1650
F0 1530 : REM ENTER SQUARE TO MOVE FROM
A5 1540 GOSUB 1690
AD 1550 : REM ENTER SQUARE TO MOVE TO
6D 1560 GOSUB 1800
DC 1570 : REM CHECK LEGALITY
6F 1580 GOSUB 2030
68 1590 IF MOVE$ = "NAUGHTY" THEN GOSUB 2210: GOTO 1
    520
E3 1600 : REM MAKE MOVE
8D 1610 GOSUB 2290
32 1620 : REM DOUBLE JUMP
F2 1630 IF JMP$ = "ON" AND DJMP$ = "ON" THEN GOSUB 2
    440: GOTO 1630
ED 1640 RETURN
FB 1650 REM ERASE LINES
B0 1660 VTAB 22: HTAB 16: PRINT SPC( 9)
4B 1670 VTAB 24: HTAB 14: PRINT SPC( 14);
FD 1680 RETURN
31 1690 REM MOVE FROM
FD 1700 DJMP$ = "": N$ = N$(PLAYER)
A6 1710 VTAB 24: HTAB 15: PRINT SPC( 11);: HTAB 21 --
    LEN (N$) / 2: PRINT N$;
10 1720 VTAB 22: HTAB 19: INVERSE : PRINT "FROM";: N
    ORMAL : PRINT CHR$ (32);: CLICK = PEEK (Z)
6E 1730 GET S$
57 1740 A = ASC (S$): IF A > 96 THEN A = A - 32
0D 1750 IF A = 27 THEN VTAB 24: HTAB 14: INVERSE : P
    RINT DBL$;: DJMP$ = "ON"
C7 1760 IF A < 65 OR A > 89 THEN 1720
70 1770 V = A - 64: R1 = FN ROW(V): C1 = FN COL(V)
A3 1780 IF B(R1,C1) < > PLAYER THEN 1720
04 1790 RETURN
E3 1800 REM MOVE TO
EC 1810 VTAB 22: HTAB 19: NORMAL : PRINT SPC( 1);: I
    NVERSE : PRINT "TO";: NORMAL : PRINT SPC( 1)
C1 1820 X = FN X(C1): Y = FN Y(R1): XL = FN XL(C1): YL
    = FN YL(R1)
A3 1830 HCOLOR= 0: DRAW 7 AT XL,YL
49 1840 HCOLOR= 3: DRAW 5 AT X,Y
EE 1850 : REM FLASH & GET
67 1860 S(1) = PLAYER: S(2) = PLAYER + 2: CNT = 1
BF 1870 GOSUB 1890

```

GAMES OF SKILL

```

02 1880 RETURN
32 1890 REM FLASH
92 1900 SHAPE = S(CNT)
17 1910 HCOLOR= K(PLAYER): DRAW SHAPE AT X,Y
69 1920 FOR PAUSE = 1 TO 15:P = PEEK ( - 16384): NEX
    T
8F 1930 HCOLOR= 0: DRAW SHAPE AT X,Y
89 1940 CNT = 3 - CNT
09 1950 IF P < 128 THEN 1900
F1 1960 POKE - 16368,0
45 1970 A = P - 128: IF A > 96 THEN A = A - 32
0A 1980 IF A = 27 THEN VTAB 24: HTAB 14: INVERSE : P
    RINT DBL$;:DJMP$ = "ON": NORMAL
97 1990 IF A < 65 OR A > 89 THEN 1900
5B 2000 V = A - 64:R2 = FN ROW(V):C2 = FN COL(V)
19 2010 IF B(R2,C2) < > 0 THEN 1900
DA 2020 RETURN
40 2030 REM CHECK LEGALITY
C1 2040 JMP$ = "":MOVE$ = "":OPP = 3 - PLAYER
8F 2050 : REM DELTAS
4E 2060 DR = ABS (R1 - R2):DC = ABS (C1 - C2)
8B 2070 : REM MIDDLE VALUES
D5 2080 MR = R1 + (R2 - R1) / 2:MC = C1 + (C2 - C1)
    / 2
8E 2090 : REM VERTICAL OR HORZ
7B 2100 IF (DR = 1 AND DC = 0) OR (DR = 0 AND DC = 1
    ) THEN 2200
0C 2110 : REM DIAGONAL
37 2120 IF (DR = 1 AND DC = 1) AND FN ED(R1 + C1) =
    1 THEN 2200
3D 2130 : REM VERTICAL JUMP
0A 2140 IF (DR = 2 AND DC = 0) AND B(MR,MC) = OPP TH
    EN JMP$ = "ON": GOTO 2200
9E 2150 : REM HORZ JUMP
0E 2160 IF (DR = 0 AND DC = 2) AND B(MR,MC) = OPP TH
    EN JMP$ = "ON": GOTO 2200
5B 2170 : REM DIAGONAL JUMP
99 2180 IF (DR = 2 AND DC = 2) AND FN ED(R1 + C1) =
    1 AND B(MR,MC) = OPP THEN JMP$ = "ON": GOTO
    2200
53 2190 MOVE$ = "NAUGHTY"
D6 2200 RETURN
46 2210 REM BAD MOVE
7B 2220 GOSUB 1650
25 2230 VTAB 22: HTAB 16: INVERSE : PRINT "NAUGHTY "
    ": NORMAL
C5 2240 FOR PAUSE = 1 TO 250:CLICK = PEEK (Z): NEXT
D0 2250 HCOLOR= K(PLAYER): DRAW PLAYER AT X,Y
8C 2260 HCOLOR= 3: DRAW 7 AT XL,YL
C2 2270 SQ = 5 * (R1 - 1) + C1: HCOLOR= 0: DRAW SQ +
    7 AT XL,YL

```

GAMES OF SKILL

```

F6 2280 RETURN
EC 2290 REM MAKE MOVE
F1 2300 : REM ERASE ORIGINAL PIECE
83 2310 RW = R1:CL = C1: GOSUB 2370
8B 2320 : REM ERASE JUMPED PIECE
DD 2330 IF JMP$ = "ON" THEN RW = MR:CL = MC: GOSUB 2
    370
52 2340 : REM PLACE ON NEW SQUARE
35 2350 RW = R2:CL = C2:B(R2,C2) = PLAYER: GOSUB 142
    0
F0 2360 RETURN
E6 2370 REM MAKE MOVE
6B 2380 X = FN X(CL):Y = FN Y(RW)
EB 2390 HCOLOR= 3: DRAW 6 AT X,Y: DRAW 6 AT X,Y - 11
4E 2400 HCOLOR= 0:SQ = 5 * (RW - 1) + CL
70 2410 DRAW SQ + 7 AT FN XL(CL), FN YL(RW)
F4 2420 B(RW,CL) = 0
E6 2430 RETURN
FF 2440 REM DOUBLE JUMP
EB 2450 R1 = R2:C1 = C2:DJMP$ = ""
CB 2460 : REM ENTER MOVE
98 2470 GOSUB 1650: VTAB 24: HTAB 16: INVERSE : PRIN
    T "JUMP AGAIN";: NORMAL
74 2480 GOSUB 1800
98 2490 : REM CHECK FOR JUMP
50 2500 GOSUB 2030
C1 2510 IF JMP$ = "" THEN GOSUB 2210: REM RE-DRAW
C3 2520 : REM MOVE
32 2530 IF JMP$ = "ON" THEN GOSUB 2290
EC 2540 RETURN
CD 2550 REM CHECK FOR END
FE 2560 GAME$ = "OVER":OPP = 3 - PLAYER:V$ = V$(OPP)
D0 2570 FOR I = 1 TO 5
55 2580 FOR J = 1 TO 5
CA 2590 IF B(I,J) = PLAYER THEN GOSUB 2620
F9 2600 NEXT J,I
E2 2610 RETURN
86 2620 REM DIRECTIONS
74 2630 FOR L = 1 TO 8
41 2640 IF FN ED(I + J) = 0 AND (L = 2 OR L = 4 OR L
    = 6 OR L = 8) THEN 2700
77 2650 IF B(I + DROW(L),J + DCOL(L)) = 0 THEN GAME$
    = "ON"
0F 2660 : REM JUMP ?
7D 2670 IF B(I + DROW(L),J + DCOL(L)) < > OPP THEN 2
    690
57 2680 IF B(I + 2 * DROW(L),J + 2 * DCOL(L)) = 0 TH
    EN GAME$ = "ON"
90 2690 IF GAME$ = "ON" THEN L = 8:J = 5:I = 5
7D 2700 NEXT L

```

GAMES OF SKILL

```
E4 2710 RETURN
56 2720 REM OUTCOME
86 2730 GOSUB 1650
CF 2740 VTAB 22: HTAB 21 - LEN (V$) / 2: INVERSE ; P
    RINT V$: NORMAL
B3 2750 FOR PAUSE = 1 TO 12: PRINT BELL$;: NEXT
F8 2760 RETURN
```


FOX AND GEESE

“Fox and Geese” is a challenging two-player game of skill and wits from the Middle Ages. Play begins with 17 geese and one fox poised for combat on a cross-shaped board. The geese must try to surround the fox so that he can’t move. The fox, on the other hand, tries to gobble up so many geese that capture is impossible.

To move the fox, enter the row and column coordinates of the square you’d like him to occupy. The fox can move to any adjacent empty square (see Figure 2-9), and he can leap two spaces by jumping a goose. The jumped goose, by the way, is removed from the board.

To double-jump, press the Escape key before you completely enter your move. The Apple will respond with the message DOUBLE JUMP to let you know that it understands.

Although the geese outnumber the fox, they’re not nearly as spry. They can’t move backward and they can’t jump. Instead, they can wobble only ahead or sideways.

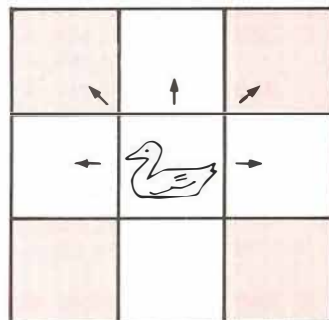
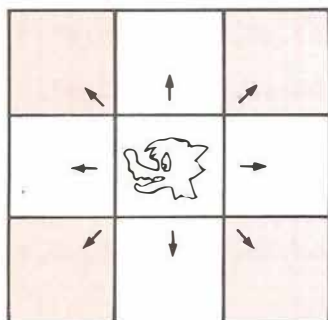
To move a web-footed fowl, first enter its row and column coordinates. The goose will start flying. Then enter the square where you’d like it to land.

The fox and the geese alternate turns until the game’s over. The fox wins if fewer than six geese remain (trapping the fox would be impossible). The fox also wins if it’s the flock’s turn, but no goose can move, or if all geese are above the fox (trapping the fox is impossible since geese can’t go backward). The geese, on the other hand, win only when they trap the fox.

In summary, then, the fox is more powerful and agile than any goose, but he’s drastically outnumbered. And the geese, while slow and individually weak, are still capable of dealing the fox a severe blow.

The Apple draws objects on the screen using shapes from a binary file. This file is created by Program 2-10A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to play the game, just run Program 2-10B. You don’t have to run Program 2-10A again.

Figure 2-9. Moving the Fox and the Geese



Program 2-10A. Fox and Geese Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

BA 100 REM SHAPES FOR FOX & GEESE
7C 110 REM DIRECTORY
75 120 DATA 23,0,48,0,158,0,23,1,119,1,199,1,4,2,61,
    2,64,3,76,3
DF 130 DATA 88,3,97,3,107,3,119,3,129,3,140,3,154,3,
    166,3,175,3,187,3
50 140 DATA 200,3,211,3,224,3,237,3
0D 150 REM FOX #1
C4 160 DATA 37,36,36,63,62,39,33,63,38,12,45,46,44,4
    6,44,42,53,45,37,45
83 170 DATA 44,61,62,62,63,63,60,55,53,61,55,53,4
    5,44,46,44,52,46,46
5C 180 DATA 45,55,63,39,63,63,63,52,46,45,45,46,63,5
    1,14,46,62,46,63,39
9B 190 DATA 36,39,44,63,54,46,54,63,37,36,60,55,63,6
    2,63,55,63,39,39,39
33 200 DATA 39,37,63,32,12,53,54,53,46,36,21,46,44,5
    4,55,45,36,44,54,37
7F 210 DATA 44,46,44,37,63,47,36,35,36,0
0C 220 REM FOX #2
BF 230 DATA 37,36,36,63,62,39,33,63,38,12,45,46,44,4
    6,44,42,53,45,37,45
7E 240 DATA 44,61,62,62,63,63,60,55,53,61,55,53,4
    5,44,46,44,52,46,46
57 250 DATA 45,55,63,39,63,63,63,52,46,45,45,46,63,5
    1,14,46,62,46,63,39
EB 260 DATA 36,39,44,63,54,46,54,63,37,60,63,63,62,5
    5,63,60,39,13,44,50
07 270 DATA 37,45,37,45,37,39,37,63,38,63,55,60,55,6
    0,63,38,60,55,36,35
    
```

GAMES OF SKILL

2B 280 DATA 61, 60, 44, 52, 45, 42, 54, 47, 53, 45, 45, 45, 61, 3
6, 52, 62, 63, 63, 60, 36, 0

3C 290 REM SITTING GOOSE

82 300 DATA 46, 45, 37, 36, 39, 44, 36, 37, 45, 53, 53, 55, 45, 4
6, 53, 61, 39, 63, 63, 60

71 310 DATA 60, 54, 47, 53, 61, 55, 53, 55, 45, 46, 50, 62, 62, 6
2, 39, 44, 44, 60, 60, 63

F6 320 DATA 63, 55, 45, 45, 53, 63, 63, 63, 46, 45, 45, 54, 39, 5
5, 39, 55, 39, 39, 55, 46

F0 330 DATA 63, 36, 39, 55, 14, 62, 39, 55, 39, 39, 45, 28, 63, 3
8, 44, 37, 63, 35, 44, 17

9D 340 DATA 37, 45, 44, 45, 53, 45, 61, 62, 55, 63, 44, 60, 55, 6
3, 54, 0

B5 350 REM FLYING GOOSE #1

33 360 DATA 39, 60, 44, 44, 50, 46, 62, 62, 46, 54, 45, 46, 45, 4
4, 37, 45, 21, 46, 46, 61

B4 370 DATA 39, 63, 62, 60, 63, 62, 55, 39, 23, 23, 39, 44, 39, 3
9, 60, 36, 60, 36, 61, 36

A9 380 DATA 39, 60, 60, 52, 54, 53, 47, 46, 54, 54, 53, 54, 53, 4
6, 54, 39, 55, 39, 60, 62

3E 390 DATA 36, 61, 55, 62, 60, 39, 63, 45, 45, 37, 44, 45, 38, 6
0, 39, 37, 47, 36, 4, 0

B0 400 REM FLYING GOOSE #2

76 410 DATA 7, 32, 61, 60, 63, 55, 63, 62, 62, 60, 39, 63, 45, 45
, 37, 45, 44, 45, 45, 53

9A 420 DATA 45, 55, 46, 44, 45, 44, 37, 45, 21, 46, 46, 61, 39, 6
3, 62, 60, 63, 62, 55, 63

5B 430 DATA 55, 55, 63, 62, 63, 38, 55, 63, 63, 62, 44, 37, 45, 4
4, 36, 37, 45, 44, 53, 5, 0

6C 440 REM OUTER BORDER

91 450 DATA 9, 9, 9, 9, 9, 9, 9, 9, 49, 54, 54, 54, 54, 63, 63, 63, 63
, 63, 63, 63, 63

91 460 DATA 63, 63, 63, 63, 63, 63, 63, 36, 36, 36, 36, 36, 36, 3
6, 36, 36, 45, 45, 45, 45

EB 470 DATA 45, 45, 45, 45, 45, 45, 45, 45, 45, 45, 45, 54, 54, 5
4, 54, 6, 0

51 480 REM BLANK SQUARE

B0 490 DATA 45, 45, 45, 45, 45, 45, 54, 54, 54, 54, 63, 63, 6
3, 63, 63, 63, 63, 63

7D 500 DATA 63, 63, 63, 63, 63, 44, 45, 45, 45, 45, 45, 45, 4
5, 45, 45, 45, 45, 37

7B 510 DATA 63, 63, 63, 63, 63, 63, 63, 63, 63, 63, 63, 63, 6
3, 44, 45, 45, 45, 45, 45

91 520 DATA 45, 45, 45, 45, 45, 45, 45, 37, 63, 63, 63, 63, 6
3, 63, 63, 63, 63, 63

DA 530 DATA 63, 63, 63, 44, 45, 45, 45, 45, 45, 45, 45, 45, 4
5, 45, 45, 45, 37, 63, 63

03 540 DATA 63, 63, 63, 63, 63, 63, 63, 63, 63, 63, 63, 44, 4
5, 45, 45, 45, 45, 45

GAMES OF SKILL

```
FA 550 DATA 45,45,45,45,45,45,37,63,63,63,63,63,63,6
3,63,63,63,63,63,63
3E 560 DATA 63,44,45,45,45,45,45,45,45,45,45,45,4
5,45,37,63,63,63,63
1B 570 DATA 63,63,63,63,63,63,63,63,63,63,44,45,45,4
5,45,45,45,45,45,45
8E 580 DATA 45,45,45,45,37,63,63,63,63,63,63,63,63,6
3,63,63,63,63,63,44
B9 590 DATA 45,45,45,45,45,45,45,45,45,45,45,45,3
7,63,63,63,63,63,63
56 600 DATA 63,63,63,63,63,63,63,63,44,45,45,45,45,4
5,45,45,45,45,45,45
7F 610 DATA 45,45,37,63,63,63,63,63,63,63,63,63,63,6
3,63,63,63,4,0
1C 620 REM LETTERS (C,o,l,u,m,n,s ; R,w)
52 630 DATA 1,8,32,59,63,50,54,54,41,45,32,0
56 640 DATA 40,21,54,30,63,7,32,36,41,5,6,0
B5 650 DATA 36,60,53,54,54,46,63,7,0
74 660 DATA 24,51,54,14,45,33,47,36,36,0
2D 670 DATA 12,53,54,62,3,32,36,59,54,54,5,0
81 680 DATA 40,21,54,62,27,35,36,44,5,0
AB 690 DATA 40,61,63,23,14,45,21,30,63,63,0
78 700 DATA 45,32,28,63,55,54,45,46,42,58,27,35,36,0
03 710 DATA 9,52,54,62,7,32,54,59,36,36,4,0
6B 720 REM NUMBERS (1 to 7)
52 730 DATA 36,60,42,54,54,46,63,7,0
24 740 DATA 45,32,28,63,23,22,17,23,46,45,37,0
BD 750 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
14 760 DATA 33,36,23,23,23,46,45,61,54,6,0
8B 770 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
D1 780 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
B3 790 DATA 12,12,60,63,55,18,17,54,6,0
ED 800 FOR I = 16384 TO 17398
A6 810 READ V
8E 820 POKE I,V
06 830 NEXT
5A 840 PRINT CHR$ (4); "BSAVE FG.SHAPE,A16384,L1015"
9A 850 END
```

Program 2-10B. Fox and Geese

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
17 100 LOMEM: 17500
09 110 REM FOX & GEESE
AB 120 REM INITIALIZE
45 130 GOSUB 230
5D 140 REM PLAY GAME
56 150 GOSUB 770
EC 160 REM PLAY AGAIN
```

GAMES OF SKILL

```

8F 170 VTAB 24: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
62 180 GET S$
E4 190 IF S$ = "Y" OR S$ = "y" THEN 150
F6 200 IF S$ < > "N" AND S$ < > "n" THEN 170
E2 210 TEXT : HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
2B 240 REM TITLE
4B 250 GOSUB 330
8B 260 REM INSTRUCTIONS
5B 270 GOSUB 390
5B 280 REM VALUES
55 290 GOSUB 530
F6 300 REM SHAPES
44 310 GOSUB 710
17 320 RETURN
2A 330 REM TITLE
2D 340 PRINT CHR$ (21): TEXT : HOME
E0 350 VTAB 12: HTAB 14: PRINT "FOX AND GEESE"
FC 360 FOR PAUSE = 1 TO 2000: NEXT
94 370 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
1C 410 PRINT " IF YOU'RE THE FOX, TRY TO GOBBLE UP"
C4 420 PRINT "THE GEESE. YOU CAN MOVE IN ANY DIREC-"
2E 430 PRINT "TION, AND YOU CAN JUMP.": PRINT
99 440 PRINT " - PRESS ";: INVERSE : PRINT "ESC";: N
    ORMAL : PRINT "APE FOR A DOUBLE JUMP."
40 450 VTAB 8: HTAB 1: PRINT " IF YOU'RE THE GEESE,
    TRY TO TRAP THE"
C8 460 PRINT "FOX. YOU CAN'T MOVE BACKWARDS, HOWEVER
    ."
6B 470 VTAB 15: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
65 480 GET S$
8F 490 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 470
89 500 K(1) = 3:K(2) = 3
24 510 IF S$ = "Y" OR S$ = "y" THEN K(1) = 6:K(2) =
    5
19 520 RETURN
51 530 REM VALUES
09 540 DIM B(11,11)
8C 550 : REM DIRECTION DELTAS
6C 560 DATA 0,1, -1,1, -1,0, -1,-1, 0,-1, 1,-1, 1,0,
    1,1
27 570 FOR I = 1 TO 8
07 580 READ DR(I),DC(I)

```


GAMES OF SKILL

```

E2 590 JR(I) = 2 * DR(I):JC(I) = 2 * DC(I)
FD 600 NEXT
DE 610 : REM X & Y COORDINATES
I9 620 DEF FN X(V) = 32 * V - 52
63 630 DEF FN Y(V) = 20 * V - 30
91 640 : REM OUTCOMES
A2 650 DATA "THE FOX WINS! LESS THAN 6 GEESE LEFT.",
    "THE FOX WINS! GEESE ARE ABOVE FOX.", "THE FOX
    WINS! NO GOOSE CAN MOVE."
F3 660 DATA "THE GEESE WIN! THE FOX IS TRAPPED."
06 670 FOR I = 1 TO 4
1D 680 READ V$(I)
10 690 NEXT
17 700 RETURN
FC 710 REM SHAPES
4E 720 HOME
1F 730 VTAB 12: HTAB 17: PRINT "READING"
38 740 PRINT CHR$(4); "BLOAD FG.SHAPE"
9C 750 POKE 233,64: POKE 232,0
23 760 RETURN
A6 770 REM PLAY
5F 780 : REM INITIALIZE
67 790 GOSUB 880
87 800 : REM MOVE
C7 810 ON PLAYER GOSUB 1450,2180
0A 820 : REM CHECK FOR END
BF 830 PLAYER = 3 - PLAYER: GOSUB 2390
7B 840 IF GAME$ = "ON" THEN 810
A0 850 : REM OUTCOME
E1 860 GOSUB 2800
26 870 RETURN
BR 880 REM INITIALIZE
49 890 : REM LABEL
54 900 GOSUB 960
E5 910 : REM RECORD POSITION
CF 920 GOSUB 1110
8D 930 : REM DRAW BOARD
DB 940 GOSUB 1320
23 950 RETURN
2C 960 REM LABEL
53 970 HOME : HGR : HCOLOR= 3: ROT= 0: SCALE= 1
37 980 FOR I = 3 TO 9
B0 990 DRAW I + 14 AT 16, FN Y(I)
48 1000 DRAW I + 14 AT FN X(I),13
A5 1010 NEXT
3F 1020 : REM 'ROWS'
99 1030 DRAW 15 AT 4,73: DRAW 9 AT 4,83
C3 1040 DRAW 16 AT 4,93: DRAW 14 AT 4,103
FE 1050 : REM 'COLUMNS'
2F 1060 X = 120

```


GAMES OF SKILL

```
2A 1070 FOR I = 8 TO 14
1E 1080 DRAW I AT X,3:X = X + 7
C5 1090 NEXT
D3 1100 RETURN
BD 1110 REM RECORD ( FOX=1; GEESE=2; BLANK=0; OFF BO
ARD=-9)
A9 1120 FOR I = 1 TO 11
2E 1130 FOR J = 1 TO 11
95 1140 B(I,J) = - 9
03 1150 NEXT J,I
08 1160 FOR I = 3 TO 9
70 1170 FOR J = 5 TO 7
95 1180 B(I,J) = 0:B(J,I) = 0
13 1190 NEXT J,I
F9 1200 FOR I = 7 TO 9
5A 1210 FOR J = 5 TO 7
1C 1220 B(I,J) = 2
FC 1230 NEXT J,I
E5 1240 FOR I = 5 TO 7
04 1250 B(I,3) = 2:B(I,9) = 2
BD 1260 NEXT
7D 1270 B(7,4) = 2:B(7,8) = 2
9E 1280 B(5,6) = 1:FROW = 5:FCOL = 6
D9 1290 GEESE = 17
55 1300 PLAYER = 1
DB 1310 RETURN
EB 1320 REM BOARD
84 1330 FOR R = 3 TO 9
01 1340 FOR C = 3 TO 9
28 1350 V = B(R,C)
50 1360 IF V = - 9 THEN 1430
72 1370 X = FN X(C):Y = FN Y(R)
51 1380 HCOLOR= 3: DRAW 6 AT X,Y
ED 1390 IF V = 0 THEN S = 7
98 1400 IF V = 1 THEN HCOLOR= K(1):S = 1
ED 1410 IF V = 2 THEN HCOLOR= K(2):S = 3
E5 1420 DRAW S AT X,Y
1E 1430 NEXT C,R
E9 1440 RETURN
17 1450 REM FOX'S TURN
12 1460 VTAB 24: HTAB 15: PRINT SPC( 11);: HTAB 18:
INVERSE : PRINT "GO FOX";: NORMAL
FA 1470 : REM ANIMATE
FE 1480 DBL$ = "":R(1) = FROW:C(1) = FCOL: GOSUB 158
0
D6 1490 : REM ENTER MOVE
03 1500 Q = 2: GOSUB 1700
C4 1510 : REM CHECK LEGALITY
69 1520 GOSUB 1910
58 1530 IF MOVE$ = "ILLEGAL" THEN 1500
```

GAMES OF SKILL

```

CA 1540 : REM MOVE
4F 1550 GOSUB 2100
32 1560 IF DBL$ = "ON" AND JMP$ = "ON" THEN GOSUB 19
    70: GOTO 1560
F7 1570 RETURN
6D 1580 REM ANIMATE
F4 1590 S(1) = 1:S(2) = 2: IF PLAYER = 2 THEN S(1) =
    4:S(2) = 5
AA 1600 X = FN X(C(1)):Y = FN Y(R(1))
25 1610 HCOLOR= 0: DRAW 7 AT X,Y
8D 1620 FOR I = 1 TO 2
12 1630 FOR J = 1 TO 2
7F 1640 HCOLOR= K(PLAYER): DRAW S(J) AT X,Y
95 1650 FOR PAUSE = 1 TO 90: NEXT PAUSE
F7 1660 HCOLOR= 0: DRAW S(J) AT X,Y
15 1670 NEXT J,I
CE 1680 HCOLOR= K(PLAYER): DRAW S(2) AT X,Y
02 1690 RETURN
C1 1700 REM GET ENTRY
7C 1710 M$(1) = "GO FROM:":M$(2) = "MOVE TO:"
C5 1720 VTAB 22: HTAB 15: PRINT M$(0)
1D 1730 VTAB 22: HTAB 24: INVERSE : PRINT "R/C"
A9 1740 : REM ROW
6A 1750 COL = 24: GOSUB 1830:R(0) = V
76 1760 : REM COL
94 1770 COL = 26: GOSUB 1830:C(0) = V
2F 1780 : REM CHECK
90 1790 IF Q = 1 AND B(R(0),C(0)) < > 2 THEN 1730
67 1800 IF Q = 2 AND B(R(0),C(0)) < > 0 THEN 1730
4D 1810 NORMAL
E9 1820 RETURN
24 1830 REM GET
08 1840 VTAB 22: HTAB COL:CLICK = PEEK (Z)
82 1850 GET S$:A = ASC (S$)
BF 1860 IF PLAYER = 1 AND A = 27 THEN DBL$ = "ON": V
    TAB 24: HTAB 15: PRINT "DOUBLE JUMP!";: GOTO
    1840
1A 1870 V = A - 48
36 1880 IF V < 1 OR V > 7 THEN 1840
EF 1890 PRINT V:V = V + 2
E3 1900 RETURN
A1 1910 REM LEGALITY
36 1920 MOVE$ = "ILLEGAL":JMP$ = "":R1 = R(1):R2 = R
    (2):C1 = C(1):C2 = C(2)
3E 1930 RD = ABS (R2 - R1):CD = ABS (C2 - C1):MR = R
    1 + INT ((R2 - R1) / 2):MC = C1 + INT ((C2 -
    C1) / 2)
37 1940 IF (RD = 1 AND CD = 0) OR (RD = 0 AND CD = 1
    ) OR (RD = 1 AND CD = 1) THEN MOVE$ = "LEGAL
    "

```

GAMES OF SKILL

```

64 1950 IF ((RD = 2 AND CD = 0) OR (RD = 0 AND CD =
      2) OR (RD = 2 AND CD = 2)) AND B(MR,MC) = 2
      THEN MOVE$ = "LEGAL":JMP$ = "ON"
FB 1960 RETURN
15 1970 REM DOUBLE JUMP
7C 1980 VTAB 24: HTAB 15: INVERSE : PRINT "JUMP AGAI
      N !";
6D 1990 DBL$ = "":R(1) = FROW:C(1) = FCOL
D7 2000 : REM ANIMATE
84 2010 GOSUB 1580
B3 2020 : REM ENTER MOVE
06 2030 Q = 2: GOSUB 1700
7C 2040 : REM CHECK FOR JUMP
6C 2050 GOSUB 1910
27 2060 IF JMP$ = "" THEN FOR I = 1 TO 250:CLICK = P
      EEK (Z): NEXT : HCOLOR= 0: DRAW 7 AT X,Y: HC
      OLOR= K(1): DRAW 1 AT X,Y
CD 2070 : REM MOVE
16 2080 IF JMP$ = "ON" THEN GOSUB 2100
F6 2090 RETURN
33 2100 REM MOVE
8C 2110 HCOLOR= 3: DRAW 7 AT FN X(C1), FN Y(R1)
84 2120 IF PLAYER = 1 AND JMP$ = "ON" THEN DRAW 7 AT
      FN X(MC), FN Y(MR):B(MR,MC) = 0:GEESE = GEE
      SE - 1
B7 2130 X = FN X(C2):Y = FN Y(R2): HCOLOR= 0: DRAW 7
      AT X,Y: HCOLOR= K(PLAYER): DRAW 2 * PLAYER
      - 1 AT X,Y
7E 2140 : REM RECORD
DC 2150 B(R1,C1) = 0:B(R2,C2) = PLAYER
37 2160 IF PLAYER = 1 THEN FROW = R2:FCOL = C2
F0 2170 RETURN
2E 2180 REM GOOSE'S TURN
46 2190 VTAB 24: HTAB 15: PRINT SPC( 12);: HTAB 17:
      INVERSE : PRINT "GO GEESE";: NORMAL
D8 2200 : REM FROM
C1 2210 Q = 1: GOSUB 1700
E3 2220 : REM ANIMATE
90 2230 GOSUB 1580
43 2240 : REM TO
12 2250 Q = 2: GOSUB 1700
1E 2260 : REM CHECK
6A 2270 GOSUB 2320
3E 2280 IF MOVE$ = "ILLEGAL" THEN HCOLOR= 0: DRAW 7
      AT X,Y: HCOLOR= K(2): DRAW 3 AT X,Y: GOTO 22
      10
D9 2290 : REM MOVE
38 2300 GOSUB 2100
DC 2310 RETURN
42 2320 REM CHECK LEGALITY

```

GAMES OF SKILL

```

68 2330 R1 = R(1):R2 = R(2):C1 = C(1):C2 = C(2):DR =
    R2 - R1:DC = C2 - C1
7C 2340 MOVE$ = "ILLEGAL"
C4 2350 FOR I = 1 TO 5
27 2360 IF DR = DR(I) AND DC = DC(I) THEN MOVE$ = "L
    EGAL":I = 5
C4 2370 NEXT
F8 2380 RETURN
D9 2390 REM CHECK FOR END
D9 2400 GAME$ = "ON"
6D 2410 IF GEESE < 6 THEN GAME$ = "OVER":TYPE = 1
D2 2420 : REM GEESE ARE ABOVE FOX
D9 2430 IF GAME$ = "ON" THEN GOSUB 2490
B5 2440 : REM GEESE CAN'T MOVE
3A 2450 IF PLAYER = 2 AND GAME$ = "ON" THEN GOSUB 25
    90
04 2460 : REM FOX CAN'T MOVE
E0 2470 IF PLAYER = 1 AND GAME$ = "ON" THEN GOSUB 27
    30
FA 2480 RETURN
C1 2490 REM GEESE ABOVE FOX
EB 2500 : REM FIND HIGHEST ROW
19 2510 HR = 0
85 2520 FOR R = 3 TO 9
02 2530 FOR C = 3 TO 9
98 2540 IF B(R,C) = 2 THEN HR = R
29 2550 NEXT C,R
E5 2560 : REM COMPARE
ED 2570 IF FROW > HR THEN GAME$ = "OVER":TYPE = 2
FC 2580 RETURN
55 2590 REM GEESE CAN'T MOVE
10 2600 MV$ = ""
83 2610 FOR R = 3 TO 9
FF 2620 FOR C = 3 TO 9
31 2630 IF B(R,C) = 2 THEN GOSUB 2680
3A 2640 IF MV$ = "YES" THEN C = 9:R = 9
28 2650 NEXT C,R
0F 2660 IF MV$ = "" THEN GAME$ = "OVER":TYPE = 3
FA 2670 RETURN
C5 2680 REM CHANCE
DA 2690 FOR I = 1 TO 5
53 2700 IF B(R + DR(I),C + DC(I)) = 0 THEN MV$ = "YE
    S"
7E 2710 NEXT I
EB 2720 RETURN
64 2730 REM FOX CAN'T MOVE
7E 2740 MV$ = "":R = FROW:C = FCOL
FC 2750 FOR I = 1 TO 8
30 2760 IF B(R + DR(I),C + DC(I)) = 0 OR (B(R + DR(I
    ),C + DC(I)) = 2 AND B(R + JR(I),C + JC(I))
    = 0) THEN MV$ = "YES":I = 8

```

GAMES OF SKILL

```
CC 2770 NEXT
1D 2780 IF MV$ = "" THEN GAME$ = "OVER":TYPE = 4
05 2790 RETURN
50 2800 REM OUTCOME
05 2810 M$ = V$(TYPE)
1D 2820 VTAB 24: HTAB 15: PRINT SPC( 12);
75 2830 VTAB 22: HTAB 15: PRINT SPC( 12);: HTAB 21 -
    LEN (M$) / 2: PRINT M$;
A8 2840 FOR I = 1 TO 10: PRINT BELL$;: NEXT
F6 2850 RETURN
```


CHAPTER 3

Household Helpers

3

Household Helpers

Computers have a reputation for being the perfect devices for doing calculations. In scientific disciplines, computers forecast the weather, explore the structure of atomic particles, and compute orbital trajectories. In the business world, they calculate our bank balances, bill our charge cards, and review our tax returns. The phrase *number cruncher* is a popular description of the computer arising from its ability to do calculations.

Almost every household performs calculations of one kind or another. Balancing a checkbook is a good example. In addition, more and more families are placing increased emphasis on health and physical fitness. This chapter presents three calculation programs and an exercise diary program. Put your personal computer to work helping you out around the house. Here are short descriptions of the programs:

Checkbook Calculator. The Apple serves as a simple calculator for handling your checkbook.

Six-Function Calculator. This more versatile calculator uses RPN logic and is suitable for more complex work.

Elapsed Time Calculator. This Apple timepiece helps you keep up with the passing hours.

Exercise Diary. The Apple can help you make a yearly log of your physical activities.

CHECKBOOK CALCULATOR

Balancing a checkbook can be an annoyance. Some people go so far as to refuse to do it; they leave this task to others or leave it undone. The mathematics of a checkbook is simple, though, since only addition and subtraction are used.

"Checkbook Calculator," Program 3-1, will help you figure your checkbook balance. You can use the program in two ways. First of all, use the program when you are writing a series of checks. Enter the checkbook's beginning balance. As you write a check, enter its amount. The program will compute the new balance for you. Write the balance in the checkbook register. The program also keeps a running total of all checks written. When you're finished writing checks, add up the individual amounts of the checks. Compare the two sums. If they match, all is well—you can be pretty sure your balance is accurate. Of course, if the totals don't match, there was an arithmetic error somewhere along the line. Go back and double-check your work carefully.

You can also use the program to balance your checkbook. Enter the checkbook balance from a particular point in time. Enter the amount of each deposit and cleared check from that point on. Jot down the total when you have accounted for all cleared checks. If you then account for uncleared checks, check fees, bank service charges, and interest earned, you can compare totals with your bank statement.

Type in Checkbook Calculator from the listing. When you run the program, you should see a display similar to that in Figure 3-1. The X's represent places where you can type in the numbers. Checks are entered as positive numbers. Deposits, however, are entered as negative numbers. For example, a \$100.00 deposit would be entered as -100.00.

If you are working with more than one checkbook, you can type BACK where the amount would normally be entered. This resets the totals to zero. Then you can start on the next checkbook.

When you're finished, type STOP in the check amount field. The program will end and control will be returned to Applesoft.

Figure 3-1. Checkbook Calculator

```
CHECKBOOK  CALCULATOR
BEGINNING BALANCE:  XXXXXXXXXXXX
CHECK AMOUNT:       XXXXXXXXXXXX
NEW BALANCE IS:     XXXXXXXXXXXX
SUM OF CHECKS IS:   XXXXXXXXXXXX
SUM OF DEPOSITS IS: XXXXXXXXXXXX
```

TYPE A NEGATIVE NUMBER FOR A DEPOSIT.
TYPE 'STOP' WHEN YOU ARE FINISHED.
TYPE 'BACK' TO START AGAIN.

Program 3-1. Checkbook Calculator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
F0 100 REM CHECKBOOK CALCULATOR (CALC.CHECKBOOK)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
3B 130 T$ = "CHECKBOOK CALCULATOR"
R"
F4 140 VTAB 1: HTAB 1: PRINT T$
3E 150 VTAB 5: PRINT "BEGINNING BALANCE:"
A1 160 VTAB 7: PRINT "CHECK AMOUNT:"
0D 170 VTAB 9: PRINT "NEW BALANCE IS:"
87 180 VTAB 15: PRINT "SUM OF CHECKS:"
4B 190 VTAB 17: PRINT "SUM OF DEPOSITS:"
0D 200 VTAB 19: HTAB 1: FOR I = 1 TO 40: PRINT "_":
NEXT I: PRINT
B1 210 VTAB 21: PRINT "TYPE A NEGATIVE NUMBER FOR A
DEPOSIT."
79 220 VTAB 22: PRINT "TYPE 'STOP' WHEN YOU ARE FINI
SHED."
D9 230 VTAB 23: PRINT "TYPE 'BACK' TO START AGAIN."
4B 240 RW = 5:CL = 25:SZ = 10: GOSUB 610: REM BEGINN
ING BALANCE
6D 250 IF R$ = "" THEN 240
3B 260 IF R$ = "STOP" OR R$ = "stop" THEN 410
3F 270 BL = VAL (R$)
89 280 RW = 7:CL = 25:SZ = 10: GOSUB 610: REM CHECK
AMOUNT
77 290 IF R$ = "" THEN 280
30 300 IF R$ = "STOP" OR R$ = "stop" THEN 410
66 310 IF R$ = "BACK" OR R$ = "back" THEN CR = 0:DE
= 0: GOTO 240
59 320 CK = VAL (R$): IF CK = 0 THEN 280
```

HOUSEHOLD HELPERS

```
79 330 BL = BL - CK: REM NEW BALANCE
09 340 IF CK >= 0 THEN DE = DE + CK
03 350 IF CK < 0 THEN CR = CR + ABS (CK)
A8 360 DB = 7:DA = 2: REM PRINT FORMAT
E9 370 N = BL: GOSUB 440: VTAB 9: HTAB 25: PRINT N$:
    REM NEW BALANCE
69 380 N = DE: GOSUB 440: VTAB 15: HTAB 25: PRINT N$
    : REM TOT CHECKS
CB 390 N = CR: GOSUB 440: VTAB 17: HTAB 25: PRINT N$
    : REM TOT DEPOSITS
16 400 GOTO 280
20 410 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU.": P
    RINT : PRINT
90 420 END
88 430 REM
59 440 REM -- PRINT USING SUBROUTINE
80 450 LET ZA$ = "*****"
CB 460 LET ZB$ = "          ":ZZ$ = "000000000":Z9$ =
    "999999999"
AF 470 IF N < 0 THEN ZS$ = "-"
D4 480 IF N >= 0 THEN ZS$ = " "
AA 490 LET ZN = ABS (N) + 5 * 10 ^ - (DA + 1)
4A 500 LET ZM$ = "0": IF DB > 0 THEN ZM$ = LEFT$ (Z9
    $,DB)
CD 510 IF DA > 0 THEN ZM$ = ZM$ + "." + LEFT$ (Z9$,D
    A)
D1 520 IF ZN > VAL (ZM$) THEN 580
70 530 LET ZW = INT (ZN):ZF = INT ((ZN - ZW) * 10 ^
    DA)
39 540 IF DA > 0 THEN ZF$ = RIGHT$ (ZZ$ + STR$ (ZF),
    DA)
6F 550 LET N$ = RIGHT$ (ZB$ + ZS$ + STR$ (ZW),DB + 1
    + (DB = 0))
40 560 IF DA > 0 THEN N$ = N$ + "." + LEFT$ (ZF$ + Z
    Z$,DA)
23 570 RETURN
75 580 LET ZS = DB + DA + 2: IF DB = 0 THEN ZS = ZS
    + 1
74 590 LET N$ = LEFT$ (ZA$,ZS)
16 600 RETURN
FD 610 REM -- LINE INPUT DRIVER
98 620 GOSUB 660: REM LINE INPUT
43 630 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
64 640 VTAB RW: HTAB CL: PRINT R$; CHR$ (13);
20 650 RETURN
A4 660 REM -- LINE INPUT SUBROUTINE
CF 670 LET ZT$ = "":R$ = "":ZP = 0
6F 680 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT
26 690 VTAB RW: HTAB CL
6F 700 INVERSE : PRINT ZT$: HTAB CL
```

HOUSEHOLD HELPERS

```
50 710 GET ZC$
9E 720 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
86 730 IF ZC$ = CHR$ (24) THEN 670: REM CTRL-X
7B 740 IF ZC$ = CHR$ (8) THEN 800: REM LEFT ARROW
CE 750 IF ZC$ = CHR$ (13) THEN 850: REM CR
FE 760 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN 7
10
8B 770 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$ =
R$ + ZC$
5B 780 LET ZP = ZP + 1: IF ZP >= SZ THEN 850
A6 790 GOTO 710
16 800 HTAB CL + ZP: PRINT " ";:ZP = ZP - 1: IF ZP <
0 THEN ZP = 0: REM BACKSPACE
53 810 HTAB CL + ZP
8B 820 IF LEN (R$) <= 1 THEN R$ = ""
87 830 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
- 1)
9D 840 GOTO 710
CE 850 NORMAL : REM CR
F7 860 PRINT CHR$ (13);
26 870 RETURN
```


SIX-FUNCTION CALCULATOR

Can a thousand-dollar personal computer perform calculations as well as an inexpensive calculator? You bet. "Six-Function Calculator," Program 3-2, does addition, subtraction, multiplication, division, exponentiation, and square roots. It's ideal when you need to do a quick calculation or two.

The calculator program uses an interesting entry method known as Reverse Polish Notation (RPN) rather than the more familiar algebraic notation. RPN, named for a Polish mathematician, is used on expensive programmable scientific and financial calculators.

RPN's most distinguishing feature is the way that numbers and operators are entered. Instead of saying $2 + 2 =$ (as on a regular calculator), you would say 2 Return 2 +. Thus, two operands are entered followed by an operator. Here are a few more examples:

Algebraic	RPN
$4 + 5 =$	4 Return 5 +
$8 / 2 =$	8 Return 2 /
$9 - 3 =$	9 Return 3 -
$7 * 6 =$	7 Return 6 *
$3 ^ 2 =$	3 Return 2 ^

Figure 3-2 is the Six-Function Calculator display. Two registers, X and Y, are displayed. These registers need some explanation. When you type in a number, you type it on the command line. When you press Return, the number is moved to the X register. Whatever was previously in the X register will be moved to the Y register. Thus, X and Y are storage registers for the two operands. Technically speaking, X and Y form a *stack*. Numbers are pushed onto and popped from the stack via the X register.

Calculations affect the registers as well. The result of a calculation is always stored in the X register. All operations except square root place a zero in the Y register. After doing a calculation, you can enter another number. The previous result will be moved to Y, and X will have the new number. Then you can enter another operator. This is how calculations are chained using the results from a previous step.

In addition to the arithmetic operators, the Six-Function Calculator recognizes four Commands:

- X** Exchange register X with register Y
- C** Clear (set to zero) register X
- F** Set the display format
- Q** Quit the calculator program

The X command is handy when you want to swap the X and Y registers. You may want to do this if the order of the numbers is incorrect. The C command places a zero in the X register without affecting the Y register. The F command controls the format in which numbers are displayed; F interprets the Y register as the number of digits to display before the decimal point and the X register as the number of digits to display after the decimal point. For example, suppose that Y was set to 3, and X to 5. The number 1.23 would be displayed as 1.23000. No more than nine digits can be displayed. An error message will appear if you attempt to display more than the maximum digits. Finally, the Q command terminates the program and returns control to Applesoft.

Figure 3-2. Six-Function Calculator

```
SIX-FUNCTION RPN CALCULATOR
NEXT COMMAND      →  XXXXXXXXXXXX
REGISTERS:        X:  XXXXXXXXXXXX
                  Y:  XXXXXXXXXXXX
```

CALCULATOR COMMANDS ARE:

- +** $X = X + Y$
- $X = X - Y$
- *** $X = X * Y$
- /** $X = X / Y$
- ^** Y TO THE X POWER
- C** CLEAR X
- F** SET DISPLAY FORMAT (Y.X)
- Q** QUIT
- S** SQUARE ROOT OF X
- X** EXCHANGE X AND Y

HOUSEHOLD HELPERS

Program 3-2. Six-Function Calculator Program

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
5C 100 REM SIX-FUNCTION CALCULATOR (CALC.SIX.FUNC)
84 110 REM
CE 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21);
2A 130 PRINT "SIX FUNCTION RPN CALCULATOR"
77 140 DB = 7:DA = 2: REM DEFAULT FORMAT
01 150 RX = 0:RY = 0: REM INIT REGISTERS
25 160 Q$ = "N"
D2 170 GOSUB 260: REM PAINT SCREEN
E9 180 GOSUB 430: REM DISPLAY REGISTERS
9E 190 GOSUB 470: REM GET COMMAND
EC 200 GOSUB 510: REM INTERPRET COMMAND
33 210 IF Q$ = "N" THEN 180
91 220 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU."
C4 230 PRINT : PRINT : PRINT
92 240 END
8D 250 REM
B7 260 REM PAINT SCREEN
CB 270 VTAB 4: HTAB 1: PRINT "NEXT COMMAND -->"
2E 280 VTAB 6: HTAB 1: PRINT "REGISTERS:    X:"
39 290 VTAB 8: HTAB 15: PRINT "Y:"
0B 300 VTAB 11: HTAB 1: FOR I = 1 TO 40: PRINT "_";:
    NEXT
17 310 VTAB 13: HTAB 1: PRINT "CALCULATOR COMMANDS A
    RE:"
FB 320 VTAB 14: HTAB 5: PRINT "+    X = X + Y"
7E 330 VTAB 15: HTAB 5: PRINT "-    X = Y - X"
BA 340 VTAB 16: HTAB 5: PRINT "*    X = X * Y"
0D 350 VTAB 17: HTAB 5: PRINT "/"    X = Y / X"
A0 360 VTAB 18: HTAB 5: PRINT "^    Y TO THE X POWER"
44 370 VTAB 19: HTAB 5: PRINT "C    CLEAR X"
DB 380 VTAB 20: HTAB 5: PRINT "F    SET DISPLAY FORMA
    T (Y,X)"
45 390 VTAB 21: HTAB 5: PRINT "Q    QUIT"
13 400 VTAB 22: HTAB 5: PRINT "S    SQUARE ROOT OF X"
E2 410 VTAB 23: HTAB 5: PRINT "X    EXCHANGE X AND Y"
18 420 RETURN
40 430 REM DISPLAY REGISTERS
9B 440 N = RX: GOSUB 820: VTAB 6: HTAB 18: PRINT N$
1E 450 N = RY: GOSUB 820: VTAB 8: HTAB 18: PRINT N$
20 460 RETURN
9D 470 REM GET COMMAND
21 480 RW = 4:CL = 18:SZ = 12: GOSUB 990
F9 490 IF R$ = "" THEN 480
15 500 RETURN
C7 510 REM INTERPRET COMMAND
E5 520 VTAB 10: HTAB 1: PRINT SPC( 40)
```

HOUSEHOLD HELPERS

```

7D 530 IF LEN (R$) = 1 AND (R$ < "0" OR R$ > "9") TH
    EN 560
8C 540 RY = RX:RX = VAL (R$): REM PUSH NUMBER
22 550 GOTO 670
87 560 IF R$ = "+" THEN RX = RX + RY:RY = 0: GOTO 67
    0
75 570 IF R$ = "-" THEN RX = RX - RY:RY = 0: GOTO 67
    0
79 580 IF R$ = "*" THEN RX = RX * RY:RY = 0: GOTO 67
    0
D1 590 IF R$ = "/" THEN GOSUB 680: GOTO 670
DD 600 IF R$ = "^" THEN RX = RX ^ RY:RY = 0: GOTO 67
    0
40 610 IF R$ = "X" OR R$ = "x" THEN T = RX:RX = RY:R
    Y = T: GOTO 670
26 620 IF R$ = "C" OR R$ = "c" THEN RX = 0: GOTO 670
8D 630 IF R$ = "F" OR R$ = "f" THEN GOSUB 740: GOTO
    670
D4 640 IF R$ = "S" OR R$ = "s" THEN RX = SQR (RX): G
    OTO 670
67 650 IF R$ = "Q" OR R$ = "q" THEN Q$ = "Y": GOTO 6
    70
2D 660 VTAB 10: HTAB 1: PRINT "TRY AGAIN."
24 670 RETURN
59 680 REM DIVIDE
7E 690 IF RX < > 0 THEN 720
69 700 VTAB 10: HTAB 1: PRINT "CAN'T DIVIDE BY ZERO.
    "
98 710 GOTO 730
1C 720 RX = RY / RX:RY = 0
1D 730 RETURN
EA 740 REM SET FORMAT
8A 750 IF ABS (RX) + ABS (RY) < 10 THEN 780
BE 760 VTAB 10: HTAB 1: PRINT "MAX DISPLAY IS 9 DIGI
    TS."
23 770 GOTO 810
85 780 DB = ABS ( INT (RY)):DA = ABS ( INT (RX))
E1 790 VTAB 6: HTAB 18: PRINT SPC( 20)
D1 800 VTAB 8: HTAB 18: PRINT SPC( 20)
1A 810 RETURN
59 820 REM -- PRINT USING SUBROUTINE
80 830 LET ZA$ = "*****"
CB 840 LET ZB$ = "          ":ZZ$ = "000000000":Z9$ =
    "999999999"
AF 850 IF N < 0 THEN ZS$ = "-"
D4 860 IF N >= 0 THEN ZS$ = " "
AA 870 LET ZN = ABS (N) + 5 * 10 ^ - (DA + 1)
5D 880 LET ZM$ = "0": IF DB > 0 THEN ZM$ = LEFT$ (Z9
    $,DB)

```

HOUSEHOLD HELPERS

```
E0 890 IF DA > 0 THEN ZM$ = ZM$ + "." + LEFT$ (Z9$,D
A)
D1 900 IF ZN > VAL (ZM$) THEN 960
70 910 LET ZW = INT (ZN):ZF = INT ((ZN - ZW) * 10 ^
DA)
39 920 IF DA > 0 THEN ZF$ = RIGHT$ (ZZ$ + STR$ (ZF),
DA)
6F 930 LET N$ = RIGHT$ (ZB$ + ZS$ + STR$ (ZW),DB + 1
+ (DB = 0))
40 940 IF DA > 0 THEN N$ = N$ + "." + LEFT$ (ZF$ + Z
Z$,DA)
23 950 RETURN
75 960 LET ZS = DB + DA + 2: IF DB = 0 THEN ZS = ZS
+ 1
74 970 LET N$ = LEFT$ (ZA$,ZS)
29 980 RETURN
11 990 REM -- LINE INPUT DRIVER
70 1000 GOSUB 1040: REM LINE INPUT
24 1010 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
66 1020 VTAB RW: HTAB CL: PRINT R$; CHR$ (13);
DD 1030 RETURN
E6 1040 REM -- LINE INPUT SUBROUTINE
3D 1050 LET ZT$ = "":R$ = "":ZP = 0
7C 1060 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT
E9 1070 VTAB RW: HTAB CL
A2 1080 INVERSE : PRINT ZT$;: HTAB CL
64 1090 GET ZC$
BA 1100 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
BA 1110 IF ZC$ = CHR$ (24) THEN 1050: REM CTRL-X
DE 1120 IF ZC$ = CHR$ (8) THEN 1180: REM LEFT ARROW
55 1130 IF ZC$ = CHR$ (13) THEN 1230: REM CR
CF 1140 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
1090
0F 1150 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
= R$ + ZC$
7B 1160 LET ZP = ZP + 1: IF ZP > = SZ THEN 1230
8C 1170 GOTO 1090
EF 1180 HTAB CL + ZP: PRINT " ":ZP = ZP - 1: IF ZP
< 0 THEN ZP = 0: REM BACKSPACE
6A 1190 HTAB CL + ZP
0F 1200 IF LEN (R$) < = 1 THEN R$ = ""
AC 1210 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
- 1)
7A 1220 GOTO 1090
3B 1230 NORMAL : REM CR
8D 1240 PRINT CHR$ (13);
E9 1250 RETURN
```


ELAPSED TIME CALCULATOR

Perhaps a member of your family is active in sports, or maybe there is a jogger in your family. You may be interested in knowing how long it takes to complete these or other activities. The jogger gets progressively happier as the elapsed time gets shorter. Success in other sports is also partly dependent on elapsed times. A serious cyclist tries to achieve faster times through a given course, just as a canoeist monitors the time required to go from one point on the river to the next.

Maybe your interests involve less activity. Perhaps you are trying to optimize the run time of an Applesoft program. You can note when the program starts and when it stops to determine the program's run time. This allows you to make and test the changes you make in the program.

No, your computer will not replace a stopwatch. However, whenever you need elapsed time calculations, you'll find "Elapsed Time Calculator," Program 3-3, most helpful.

Figure 3-3 is the Elapsed Time Calculator display. Starting and ending times may be entered in either 12- or 24-hour format. The starting and ending time formats must be consistent, though. You cannot mix 12- and 24-hour formats.

Enter times in units of hours, minutes, and seconds, with colons separating the divisions; you don't need to type in the colons. Hours range in value from 1 to 12, or from 0 to 24, depending on the time format. Minutes and seconds range from 0 to 59. If you are using the 12-hour format, you'll have to type in AM or PM as appropriate.

After you enter the starting and ending times, the program will compute and display the elapsed time in both hours, minutes, and seconds as well as total elapsed seconds.

Be careful when the ending time is less than the starting time. Suppose that the starting time is 2:15:00 PM and the ending time is 1:30:15 PM. The Elapsed Time Calculator will assume that the ending time is 1:30:15 PM the next day. Of course, the ending time could have actually been a week later. However, the program will not compute elapsed times greater than 24 hours long.

HOUSEHOLD HELPERS

Here are some examples of elapsed time calculations. If you have successfully typed in the program, you should get the same results.

Starting Time	Ending Time	Elapsed Time	Elapsed Seconds
10:30:10 AM	4:05:02 PM	5:34:52	20092
12:00:01 PM	11:30:45 AM	11:30:44	41444
08:59:59	16:40:20	7:40:21	27621
19:47:12	02:09:51	6:22:39	22959

To leave the program, just indicate when prompted that you do not want to do another calculation. Control will return to Applesoft.

Figure 3-3. Elapsed Time Calculator

ELAPSED TIME CALCULATOR

WHICH TIME FORMAT? X

1 12 HOURS AM AND PM

2 24 HOURS

	HH	MM	SS				
STARTING TIME:	XX	:	XX	:	XX	XX	AM/PM
ENDING TIME:	XX	:	XX	:	XX	XX	AM/PM
ELAPSED TIME:	XXXXXXXXXXXX						
ELAPSED SECONDS:	XXXXXXXXXXXX						

ANOTHER CALCULATION (Y OR N)?

Program 3-3. Elapsed Time Calculator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
4F 100 REM ELAPSED TIME CALCULATOR (CALC.TIME)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
54 130 T$ = "ELAPSED TIME CALCULATOR"
05 140 VTAB 1: HTAB 8: PRINT T$
23 150 Q$ = "N"
CE 160 GOSUB 250: REM PAINT SCREEN
2A 170 GOSUB 390: REM ERASE FIELDS
8D 180 GOSUB 510: REM GET TIME FORMAT
09 190 GOSUB 560: REM GET TIMES
8E 200 GOSUB 920: REM COMPUTE ELAPSED
32 210 IF Q$ = "N" THEN 170
```

HOUSEHOLD HELPERS

```

20 220 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU.": P
   RINT : PRINT
90 230 END
88 240 REM
85 250 REM PAINT SCREEN
14 260 VTAB 4: HTAB 1: PRINT "WHICH TIME FORMAT?
96 270 VTAB 5: HTAB 1: PRINT "  1  12 HOURS AM AND P
   M"
0E 280 VTAB 6: HTAB 1: PRINT "  2  24 HOURS"
5C 290 VTAB 9: HTAB 19: PRINT "HH  MM  SS"
44 300 VTAB 11: HTAB 1: PRINT "STARTING TIME:"
F0 310 VTAB 11: HTAB 22: PRINT ":      :      AM/PM"
10 320 VTAB 13: HTAB 1: PRINT "ENDING TIME:"
F6 330 VTAB 13: HTAB 22: PRINT ":      :      AM/PM"
4D 340 VTAB 15: HTAB 1: PRINT "ELAPSED TIME:"
84 350 VTAB 17: HTAB 1: PRINT "ELAPSED SECONDS:"
97 360 VTAB 21: HTAB 1: FOR I = 1 TO 40: PRINT "  ,.
   NEXT
5A 370 VTAB 23: HTAB 1: PRINT "ANOTHER CALCULATION (
   Y OR N)? "
23 380 RETURN
E6 390 REM ERASE FIELDS
C4 400 VTAB 11: HTAB 19: PRINT "  "
84 410 VTAB 11: HTAB 24: PRINT "  "
09 420 VTAB 11: HTAB 29: PRINT "  "
48 430 VTAB 11: HTAB 33: PRINT "  "
CE 440 VTAB 13: HTAB 19: PRINT "  "
8E 450 VTAB 13: HTAB 24: PRINT "  "
13 460 VTAB 13: HTAB 29: PRINT "  "
52 470 VTAB 13: HTAB 33: PRINT "  "
DF 480 VTAB 15: HTAB 18: PRINT SPC( 15)
64 490 VTAB 17: HTAB 19: PRINT SPC( 15)
15 500 RETURN
A8 510 REM GET TIME FORMAT
DE 520 RW = 4:CL = 20:SZ = 2: GOSUB 1300
0F 530 IF R$ < > "1" AND R$ < > "2" THEN 520
77 540 TM$ = R$
1F 550 RETURN
52 560 REM GET TIMES
DF 570 RW = 11:SZ = 2
CF 580 CL = 19: GOSUB 1300:H1 = VAL (R$)
D3 590 IF TM$ = "1" AND (H1 < 1 OR H1 > 12) THEN 580
C8 600 IF TM$ = "2" AND (H1 < 0 OR H1 > 24) THEN 580
A8 610 CL = 24: GOSUB 1300:M1 = VAL (R$)
27 620 IF M1 < 0 OR M1 > 59 THEN 610
5F 630 CL = 29: GOSUB 1300:S1 = VAL (R$)
5C 640 IF S1 < 0 OR S1 > 59 THEN 630
08 650 IF H1 = 24 AND M1 < > 0 AND S1 < > 0 THEN 580
06 660 IF TM$ = "2" THEN 730
82 670 CL = 33: GOSUB 1300: IF R$ = "" THEN 670

```

HOUSEHOLD HELPERS

```
21 680 IF R$ = "am" THEN R$ = "AM"
32 690 IF R$ = "pm" THEN R$ = "PM"
FA 700 IF R$ < > "AM" AND R$ < > "PM" THEN 670
B1 710 T1$ = R$
D9 720 IF TM$ = "1" AND T1$ = "PM" THEN H1 = H1 + 12
30 730 T1 = (H1 * 3600) + (M1 * 60) + S1
DC 740 RW = 13:SZ = 2
DB 750 CL = 19: GOSUB 1300:H2 = VAL (R$)
4E 760 IF TM$ = "1" AND (H2 < 1 OR H2 > 12) THEN 750
56 770 IF TM$ = "2" AND (H2 < 0 OR H2 > 24) THEN 750
C7 780 CL = 24: GOSUB 1300:M2 = VAL (R$)
77 790 IF M2 < 0 OR M2 > 59 THEN 780
6B 800 CL = 29: GOSUB 1300:S2 = VAL (R$)
6B 810 IF S2 < 0 OR S2 > 59 THEN 800
C3 820 IF H2 = 24 AND M2 < > 0 AND S2 < > 0 THEN 750
FD 830 IF TM$ = "2" THEN 900
7D 840 CL = 33: GOSUB 1300: IF R$ = "" THEN 840
1D 850 IF R$ = "am" THEN R$ = "AM"
2E 860 IF R$ = "pm" THEN R$ = "PM"
C9 870 IF R$ < > "AM" AND R$ < > "PM" THEN 840
D0 880 T2$ = R$
7A 890 IF TM$ = "1" AND T2$ = "PM" THEN H2 = H2 + 12
43 900 T2 = (H2 * 3600) + (M2 * 60) + S2
1B 910 RETURN
4D 920 REM ELAPSED TIME
05 930 IF T2 < T1 THEN T2 = T2 + 86400: REM ADD 24 H
    OURS
AD 940 DS = T2 - T1
3E 950 HS = DS
B1 960 HH = INT (HS / 3600)
1F 970 HS = HS - (HH * 3600): IF HS < 0 THEN HS = 0
85 980 MM = INT (HS / 60)
80 990 HS = HS - (MM * 60): IF HS < 0 THEN HS = 0
BA 1000 SS = HS
11 1010 DB = 2:DA = 0
3E 1020 N = HH: GOSUB 1130: VTAB 15: HTAB 18: PRINT
    N$;" : "
C3 1030 N = MM: GOSUB 1130: VTAB 15: HTAB 23: PRINT
    N$;" : "
CD 1040 N = SS: GOSUB 1130: VTAB 15: HTAB 28: PRINT
    N$
23 1050 DB = 6:DA = 0
54 1060 N = DS: GOSUB 1130: VTAB 17: HTAB 19: PRINT
    N$
9C 1070 RW = 23:CL = 31:SZ = 2: GOSUB 1300
51 1080 IF R$ = "y" THEN R$ = "Y"
78 1090 IF R$ = "n" THEN R$ = "N"
4D 1100 IF R$ < > "Y" AND R$ < > "N" THEN 1070
89 1110 IF R$ = "N" THEN Q$ = "Y"
DB 1120 RETURN
```

HOUSEHOLD HELPERS

```

5A 1130 REM -- PRINT USING SUBROUTINE
A8 1140 LET ZA$ = "*****"
3F 1150 LET ZB$ = " " : ZZ$ = "0000000000": Z9$
    = "9999999999"
07 1160 IF N < 0 THEN ZS$ = "-"
51 1170 IF N >= 0 THEN ZS$ = " "
FC 1180 LET ZN = ABS (N) + 5 * 10 ^ - (DA + 1)
62 1190 LET ZM$ = "0": IF DB > 0 THEN ZM$ = LEFT$ (Z
    9$, DB)
43 1200 IF DA > 0 THEN ZM$ = ZM$ + "." + LEFT$ (Z9$,
    DA)
7D 1210 IF ZN > VAL (ZM$) THEN 1270
88 1220 LET ZW = INT (ZN): ZF = INT ((ZN - ZW) * 10 ^
    DA)
1A 1230 IF DA > 0 THEN ZF$ = RIGHT$ (ZZ$ + STR$ (ZF)
    , DA)
86 1240 LET N$ = RIGHT$ (ZB$ + ZS$ + STR$ (ZW), DB +
    1 + (DB = 0))
2B 1250 IF DA > 0 THEN N$ = N$ + "." + LEFT$ (ZF$ +
    ZZ$, DA)
ED 1260 RETURN
92 1270 LET ZS = DB + DA + 2: IF DB = 0 THEN ZS = ZS
    + 1
90 1280 LET N$ = LEFT$ (ZA$, ZS)
F9 1290 RETURN
A3 1300 REM -- LINE INPUT DRIVER
8E 1310 GOSUB 1350: REM LINE INPUT
2E 1320 VTAB RW: HTAB CL: PRINT SPC (SZ); CHR$ (13);
70 1330 VTAB RW: HTAB CL: PRINT R$; CHR$ (13);
E7 1340 RETURN
F0 1350 REM -- LINE INPUT SUBROUTINE
47 1360 LET ZT$ = "": R$ = "": ZP = 0
86 1370 FOR ZI = 1 TO SZ: ZT$ = ZT$ + " ": NEXT
F3 1380 VTAB RW: HTAB CL
AC 1390 INVERSE : PRINT ZT$;: HTAB CL
48 1400 GET ZC$
C4 1410 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
47 1420 IF ZC$ = CHR$ (24) THEN 1360: REM CTRL-X
2A 1430 IF ZC$ = CHR$ (8) THEN 1490: REM LEFT ARROW
E1 1440 IF ZC$ = CHR$ (13) THEN 1540: REM CR
56 1450 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    1400
19 1460 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;: R$
    = R$ + ZC$
D2 1470 LET ZP = ZP + 1: IF ZP >= SZ THEN 1540
7A 1480 GOTO 1400
F9 1490 HTAB CL + ZP: PRINT " ";: ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
4E 1500 HTAB CL + ZP
19 1510 IF LEN (R$) <= 1 THEN R$ = ""

```

HOUSEHOLD HELPERS

```
B6 1520 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$  
    ) - 1)  
68 1530 GOTO 1400  
45 1540 NORMAL : REM CR  
97 1550 PRINT CHR$ (13);  
F3 1560 RETURN
```

EXERCISE DIARY

Americans are on an exercise binge. Hiking, biking, walking, canoeing, sailing, and swimming are all increasingly popular activities. "Exercise Diary," Program 3-4, helps you keep track of all this physical activity. It creates an electronic record of when you exercised, how long it took (time and distance), and what the weather was like, among other things.

With this kind of data on file, it's fun to flip through your past entries. The Diary can display details of any exercise session, display a monthly calendar of your activity, and generate monthly and yearly totals. It's versatile enough to track any kind of sport in which activity is measured in miles. Don't worry if you hike, bike, and canoe at various times. Exercise Diary will create files for each separate activity on a yearly basis, and you don't need to change the program to accomplish this. The Diary can serve as an electronic scrapbook to refresh your memory of past activities. For anyone in training, it can help measure progress in meeting an athletic or conditioning goal.

Here's an example demonstrating how to use Exercise Diary. Suppose you like to hike in the Blue Ridge Mountains of Virginia occasionally, and you recently trekked along the Dark Hollow Falls Trail in the Shenandoah National Park. When you log this hike into Exercise Diary, the Apple will first ask if you want to start a new logbook, open an old one, view all logbook names on the disk, delete a logbook, or exit. Assuming that your logbook is new, select the first option.

The Apple responds by asking you to enter the present and past tenses of the name of your exercise. Respond with HIKE and HIKED. The program uses these words throughout the Diary, and it eventually creates a file called HIKE1985 after you've keyed in the year.

Now, following the Apple's prompts, describe the hike:

MILES: 8.2

MINUTES: 160

LOCATION: Dark Hollow Falls

COMMENTS: Hot and sunny, but nice breeze at falls

The computer records your data on disk and returns to the main menu.

HOUSEHOLD HELPERS

In the second option, opening an old logbook, you can do several things. First, you can review and edit any past exercise session. Next, you can add another session to your diary, such as a hike along Rip-Rap Run on September 30. Or you can review monthly figures. In this case, the Apple draws a calendar on your screen (January 1985, for example), and you have the option of displaying dates, daily miles logged, or miles per hour. Finally, you can ask the Apple to tally monthly and yearly totals.

In the third option, viewing logbook names, you might see something like this:

HIKE1985 HIKE1984 CANOE1985 BIKE1985

If you forget which files you have on disk, don't worry. Simply use this option to refresh your memory. The fourth, and final, option enables you to delete a logbook that you no longer want to save.

Whether you hike or bike or swim or ski, you'll find the Diary a handy and entertaining way of tracking your activity. And who knows, it may just give you the incentive to forgo that piece of pastry and take a brisk walk around the block.

Program 3-4. Exercise Diary

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
04 100 REM EXERCISE DIARY
06 110 REM INITIALIZE
0E 120 GOSUB 190
53 130 REM SELECT FROM MENU
58 140 GOSUB 790
91 150 REM CONTINUE
16 160 IF PICK < > 5 THEN 140
0E 170 HOME : PRINT "BYE-BYE"
99 180 END
B6 190 REM INITIALIZE
45 200 : REM TITLE
0E 210 GOSUB 290
FB 220 : REM INSTRUCTIONS
49 230 GOSUB 340
B9 240 : REM KEY VALUES
4C 250 GOSUB 430
15 260 : REM LOGBOOK NAMES
52 270 GOSUB 630
22 280 RETURN
35 290 REM TITLE
25 300 PRINT CHR$ (21): TEXT : HOME
```

HOUSEHOLD HELPERS

```
9F 310 VTAB 12: HTAB 13: PRINT "EXERCISE DIARY"
79 320 FOR PAUSE = 1 TO 1500: NEXT
19 330 RETURN
85 340 REM INSTRUCTIONS
50 350 HOME
A6 360 PRINT "THIS PROGRAM HELPS TRACK YOUR PHYSICAL
"
8F 370 PRINT "ACTIVITY THROUGHOUT THE YEAR.": PRINT
50 380 PRINT "FOR BEST RESULTS, USE THIS ROUTINE AND
"
09 390 PRINT "ITS FILES ON A SEPARATE DISKETTE."
5C 400 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
57 410 GET S$
18 420 RETURN
3D 430 REM INITIAL VALUES
4F 440 HOME
9F 450 VTAB 12: HTAB 16: PRINT "READING"
D6 460 X = 366:BY = 1978:D$ = CHR$(4):BELL$ = CHR$(7):Z = - 16336
AC 470 DIM MILES(X),TIME(X),LC$(X),CM$(X),MT$(12),M$(12),DAY(12),FILE$(50)
09 480 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST,SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
05 490 DATA 31,28,31,30,31,30,31,31,30,31,30,31
AD 500 DATA SUN,MON,TUE,WED,THR,FRI,SAT
0E 510 FOR I = 1 TO 12
CA 520 READ MT$(I)
0D 530 M$(I) = LEFT$(MT$(I),1)
05 540 NEXT
EE 550 FOR I = 1 TO 12: READ DAY(I): NEXT
38 560 FOR I = 1 TO 7: READ DW$(I): NEXT
5F 570 MT$ = "J F M A M J J A S O N D"
1B 580 C$(1) = "DATES":C$(2) = "MILES":C$(3) = "MIN/MILE":C$(4) = "EXIT"
BF 590 DATA START A NEW LOGBOOK,OPEN AN OLD ONE
8A 600 DATA VIEW LOGBOOK NAMES,DELETE A LOGBOOK,EXIT
19 610 FOR I = 1 TO 5: READ PICK$(I): NEXT
1A 620 RETURN
44 630 REM READ NAMES
A9 640 NF = 0
BE 650 ONERR GOTO 750
2A 660 PRINT D$;"OPEN EXCAT"
F4 670 PRINT D$;"READ EXCAT"
7C 680 INPUT NF
49 690 FOR I = 1 TO NF
73 700 INPUT FILE$(I)
01 710 NEXT
BB 720 PRINT D$;"CLOSE"
9F 730 GOTO 760
66 740 : REM DELETE FILE
```

HOUSEHOLD HELPERS

```
1E 750 PRINT D$;"CLOSE": PRINT D$;"DELETE EXCAT"
31 760 POKE 216,0: CALL - 3288
58 770 HOME
27 780 RETURN
68 790 REM MENU
86 800 VTAB 5: HTAB 11: PRINT "WOULD YOU LIKE TO"
06 810 FOR I = 1 TO 5
75 820 VTAB I * 2 + 6: HTAB 12: INVERSE : PRINT I;:
    NORMAL : PRINT CHR$ (32);PICK$(I)
06 830 NEXT
A2 840 VTAB 19: HTAB 11: PRINT "=> ? ";BELL$;
53 850 GET S$
65 860 PICK = VAL (S$)
6C 870 IF PICK < 1 OR PICK > 5 THEN 840
45 880 : REM NO FILES
A0 890 IF (PICK = 2 OR PICK = 3 OR PICK = 4) AND NF
    = 0 THEN VTAB 1: HTAB 1: PRINT "THERE AREN'T
    ANY LOGBOOKS ON FILE.": GOTO 840
FD 900 ON PICK GOSUB 920,2890,4920,5020
1B 910 RETURN
FC 920 REM NEW BOOK
43 930 : REM ENTER EXERCISE
0F 940 GOSUB 1140
50 950 : REM ENTER YEAR
ED 960 GOSUB 1260
E5 970 : REM CHECK FOR DUPLICATE & ASK TO CONTINUE
F4 980 DUP$ = "":CH = 0
66 990 IF NF > 0 THEN GOSUB 1380
98 1000 IF DUP$ = "YES" THEN GOSUB 1430
77 1010 IF CH = 2 THEN 1130
7B 1020 : REM SET VALUES TO 0
73 1030 GOSUB 1550
04 1040 : REM ENTER # OF TREKS
6F 1050 GOSUB 1630
BC 1060 : REM LOG THEM
57 1070 FOR I = 1 TO N
6F 1080 GOSUB 1710
8F 1090 NEXT I
58 1100 : REM SAVE FILE
88 1110 IF DUP$ = "" THEN NF = NF + 1:FILE$(NF) = FI
    LE$
73 1120 GOSUB 4640
0F 1130 RETURN
0B 1140 REM NAME OF EXERCISE
4E 1150 HOME
61 1160 PRINT "PLEASE ENTER THE ";: INVERSE : PRINT
    "PRESENT";: NORMAL : PRINT " AND THEN THE"
8A 1170 INVERSE : PRINT "PAST";: NORMAL : PRINT " TE
    NSE OF YOUR EXERCISE.": PRINT
```

HOUSEHOLD HELPERS

```

07 1180 PRINT "FOR EXAMPLE, ENTER 'JOG' AND 'JOGGED,"
E3 1190 PRINT "OR 'HIKE' AND 'HIKED.'"
70 1200 FOR I = 1 TO 2
50 1210 CLICK = PEEK (Z)
57 1220 VTAB 2 * I + 5: HTAB 1: PRINT "WORD #";I;: I
    NPUT " = ? ";WD$(I)
91 1230 IF WD$(I) = "" THEN 1210
85 1240 NEXT
E9 1250 RETURN
52 1260 REM YEAR
58 1270 HOME
0F 1280 PRINT "PLEASE ENTER A FOUR-DIGIT YEAR FOR"
DD 1290 PRINT "YOUR LOGBOOK."
47 1300 VTAB 4: HTAB 10: PRINT SPC( 20);BELL$
8C 1310 VTAB 4: HTAB 1: INPUT "YEAR = ? ";Y$
0F 1320 YEAR = INT ( VAL (Y$))
38 1330 IF YEAR < BY OR YEAR > 2100 THEN VTAB 22: HT
    AB 6: PRINT "PLEASE ENTER ";BY;" TO 2100 !":
        GOTO 1300
06 1340 DY = 365:DAY(2) = 28
7C 1350 IF YEAR / 4 = INT (YEAR / 4) THEN DY = 366:D
    AY(2) = 29
7F 1360 FILE$ = WD$(1) + STR$ (YEAR)
F3 1370 RETURN
81 1380 REM CHECK FOR DUPLICATE
3E 1390 FOR I = 1 TO NF
9E 1400 IF FILE$(I) = FILE$ THEN DUP$ = "YES"
AD 1410 NEXT
E1 1420 RETURN
B0 1430 REM DUPLICATE
50 1440 HOME
F9 1450 INVERSE : PRINT FILE$;: NORMAL : PRINT " IS
    ALREADY ON FILE. IT WILL"
87 1460 PRINT "BE WRITTEN OVER IF YOU CONTINUE."
D7 1470 VTAB 9: HTAB 13: PRINT "WOULD YOU LIKE TO"
F2 1480 VTAB 12: HTAB 14: INVERSE : PRINT "1";: NORM
    AL : PRINT " CONTINUE"
72 1490 VTAB 14: HTAB 14: INVERSE : PRINT "2";: NORM
    AL : PRINT " RETURN TO MENU"
DE 1500 VTAB 17: HTAB 13: PRINT "=> ? ";BELL$;
62 1510 GET S$
B3 1520 CH = VAL (S$): IF CH < 1 OR CH > 2 THEN 1500
4E 1530 HOME
EB 1540 RETURN
AF 1550 REM SET VALUES TO 0
5A 1560 HOME
E7 1570 VTAB 12: HTAB 14: PRINT "INITIALIZING"
06 1580 FOR I = 1 TO X
B5 1590 MILES(I) = 0:TIME(I) = 0

```

HOUSEHOLD HELPERS

```

EF 1600 LC$(I) = "":CM$(I) = ""
B1 1610 NEXT
E5 1620 RETURN
C6 1630 REM EXERCISE SESSIONS
54 1640 HOME
72 1650 PRINT "HOW MANY EXERCISE SESSIONS DO YOU WANT"
T"
E4 1660 VTAB 2: HTAB 13: PRINT SPC( 20);BELL$
8E 1670 VTAB 2: HTAB 1: INPUT "TO RECORD ? ";S$
8B 1680 N = INT ( VAL (S$))
17 1690 IF N < 1 OR N > DY THEN 1660
DF 1700 RETURN
31 1710 REM LOG AN EXERCISE
11 1720 REM DRAW BOX
91 1730 GOSUB 1950
99 1740 REM ENTER MONTH
87 1750 GOSUB 2070
80 1760 REM ENTER DATE
77 1770 GOSUB 2230
E6 1780 REM COMPUTE DAY OF YEAR
73 1790 GOSUB 2310
CD 1800 REM ENTER MILES
8D 1810 GOSUB 2380
3A 1820 REM ENTER MINUTES
9F 1830 IF MILES(K) < > 0 THEN GOSUB 2490
94 1840 REM ENTER LOCATION
27 1850 IF MILES(K) < > 0 THEN GOSUB 2600
CB 1860 REM ENTER COMMENTS
7F 1870 IF MILES(K) < > 0 THEN GOSUB 2840
5D 1880 REM CORRECTIONS
E7 1890 VTAB 22: HTAB 12: PRINT "CHANGES (Y/N) ? ";BELL$;
66 1900 GET S$
F6 1910 IF S$ = "Y" OR S$ = "y" THEN 1800
13 1920 IF S$ < > "N" AND S$ < > "n" THEN 1890
40 1930 IF MILES(K) = 0 THEN TIME(K) = 0:LC$(K) = "":CM$(K) = ""
F3 1940 RETURN
8D 1950 REM BOX
31 1960 HOME : INVERSE
CB 1970 VTAB 1: HTAB 1: PRINT SPC( 39)
CD 1980 VTAB 2: HTAB 1: PRINT SPC( 39)
D2 1990 VTAB 3: HTAB 1: PRINT SPC( 39)
31 2000 VTAB 24: HTAB 1: PRINT SPC( 39);
7F 2010 FOR R = 4 TO 23
33 2020 VTAB R: HTAB 1: PRINT SPC( 1)
96 2030 VTAB R: HTAB 39: PRINT SPC( 1)
85 2040 NEXT R
4E 2050 NORMAL
EA 2060 RETURN

```

HOUSEHOLD HELPERS

```
BF 2070 REM MONTH
43 2080 COL = 10:M = 1
B4 2090 VTAB 5: HTAB 3: PRINT "MONTH: ";MT$
E0 2100 VTAB 22: HTAB 3: PRINT "USE ARROWS TO MOVE;
    THEN HIT ";: INVERSE : PRINT "RETURN"
36 2110 VTAB 5: HTAB COL: INVERSE : PRINT M$(M): CHR
    $(8):CLICK = PEEK (Z)
5F 2120 GET S$
BC 2130 A = ASC (S$)
68 2140 NORMAL : PRINT M$(M): CHR$(8):
F8 2150 IF A = 8 THEN M = M - 1
5F 2160 IF A = 21 THEN M = M + 1
8F 2170 IF M = 0 THEN M = 12
33 2180 IF M = 13 THEN M = 1
D7 2190 COL = 8 + 2 * M
66 2200 IF A < > 13 THEN 2110
41 2210 HTAB 10: PRINT SPC( 23): HTAB 10: PRINT MT$
    (M)
DE 2220 RETURN
AA 2230 REM DATE
AA 2240 VTAB 22: HTAB 3: PRINT SPC( 35)
D7 2250 VTAB 6: HTAB 4: PRINT "DATE: "; SPC( 20):BEL
    L$
27 2260 VTAB 6: HTAB 9: INPUT " ";S$
C4 2270 VTAB 6: HTAB 39: INVERSE : PRINT SPC( 1): NO
    RMAL
14 2280 D = INT ( VAL (S$))
F2 2290 IF D < 1 OR D > DAY(M) THEN 2250
D8 2300 RETURN
66 2310 REM DAY OF THE YEAR
0B 2320 K = 0
BE 2330 FOR J = 1 TO M
86 2340 K = K + DAY(J)
87 2350 NEXT J
5E 2360 K = K - (DAY(M) - D)
F4 2370 RETURN
D8 2380 REM MILES
53 2390 T$ = "MILES " + WD$(2) + ": "
47 2400 VTAB 22: HTAB 12: PRINT SPC( 15)
8D 2410 VTAB 10: HTAB 3: INVERSE : PRINT T$: COL = P
    OS (0) + 1: NORMAL
14 2420 VTAB 10: HTAB COL + 1: PRINT MILES(K):BELL$
EF 2430 VTAB 10: HTAB COL: INPUT " ";S$
D0 2440 VTAB 10: HTAB 39: INVERSE : PRINT SPC( 1): N
    ORMAL
07 2450 IF S$ < > "" THEN MILES(K) = VAL (S$)
68 2460 IF MILES(K) < 0 THEN 2420
A7 2470 VTAB 10: HTAB COL + 1: PRINT MILES(K)
FA 2480 RETURN
05 2490 REM MINUTES
```


HOUSEHOLD HELPERS

```

6F 2500 VTAB 12: HTAB COL - 8: INVERSE : PRINT "MINU
    TES:": NORMAL
27 2510 VTAB 12: HTAB COL + 1: PRINT SPC( 10);: HTAB
    COL + 1: PRINT TIME(K);BELL$
F1 2520 VTAB 12: HTAB COL: INPUT " ";S$
D2 2530 VTAB 12: HTAB 39: INVERSE : PRINT SPC( 1): N
    ORMAL
76 2540 IF S$ < > "" THEN TIME(K) = VAL (S$)
J0 2550 IF TIME(K) < 0 THEN 2510
FC 2560 MM = TIME(K) / MILES(K)
7F 2570 IF MM > 99.9 THEN VTAB 12: HTAB COL + 1: PRI
    NT "SPEED UP !";: FOR PAUSE = 1 TO 10: PRINT
    BELL$;: NEXT PAUSE: GOTO 2510
2F 2580 VTAB 12: HTAB COL + 1: PRINT TIME(K)
01 2590 RETURN
77 2600 REM LOCATION
82 2610 VTAB 16: HTAB 3: PRINT "LOCATION:"
3C 2620 ROW = 16:PH$ = LC$(K): GOSUB 2650
80 2630 IF COL < > 13 THEN LC$(K) = P$
EE 2640 RETURN
AE 2650 REM PHRASE
1E 2660 COL = 13:P$ = "": INVERSE
F7 2670 VTAB ROW: HTAB COL: PRINT SPC( 24);: HTAB CO
    L: PRINT PH$
99 2680 VTAB ROW: HTAB COL
02 2690 GET L$
A0 2700 A = ASC (L$)
88 2710 IF A > 96 THEN A = A - 32:L$ = CHR$ (A)
01 2720 IF (COL = 13 AND A = 8) OR (COL = 37 AND A <
    > 8 AND A < > 13) THEN PRINT BELL$: GOTO 26
    80
38 2730 IF A = 8 THEN GOSUB 2780
D8 2740 IF A < > 8 AND A < > 13 THEN PRINT L$;:P$ =
    P$ + L$:COL = COL + 1
97 2750 IF A < > 13 THEN 2680
60 2760 NORMAL
FC 2770 RETURN
82 2780 REM MOVE CURSOR LEFTWARD
D0 2790 IF LEN (P$) = 1 THEN P$ = ""
6D 2800 IF LEN (P$) > 1 THEN P$ = LEFT$ (P$, LEN (P$
    ) - 1)
D7 2810 COL = COL - 1
1E 2820 PRINT CHR$ (8); SPC( 1)
EE 2830 RETURN
05 2840 REM COMMENTS
14 2850 VTAB 18: HTAB 3: PRINT "COMMENTS:"
D9 2860 ROW = 18:PH$ = CM$(K): GOSUB 2650
AA 2870 IF COL < > 13 THEN CM$(K) = P$
03 2880 RETURN
26 2890 REM OLD BOOK

```

HOUSEHOLD HELPERS

```

55 2900 : REM INITIALIZE
7E 2910 GOSUB 1550
CD 2920 : REM ENTER FILE NAME
7E 2930 GOSUB 3060
F7 2940 : REM CHECK EXISTENCE
9F 2950 DUP$ = "": GOSUB 1380
92 2960 IF DUP$ = "" THEN HOME : INVERSE : PRINT FIL
    E$;: NORMAL : PRINT " IS NOT ON FILE.": GOTO
    3050
8F 2970 : REM READ DATA
96 2980 GOSUB 3160
1C 2990 : REM SELECT FROM MENU
79 3000 GOSUB 3280
F9 3010 ON CHOICE GOSUB 1710,3430,4400
86 3020 IF CHOICE < > 4 THEN 3000
43 3030 : REM SAVE DATA
78 3040 GOSUB 4640
E7 3050 RETURN
6A 3060 REM FILE NAME
56 3070 HOME
24 3080 PRINT "PLEASE ENTER THE NAME OF YOUR FILE.":
    BELL$
8D 3090 VTAB 3: HTAB 1: INPUT "NAME = ? ":FILE$
C5 3100 IF FILE$ = "" THEN 3090
F7 3110 S$ = RIGHT$ (FILE$,4)
D1 3120 YEAR = INT ( VAL (S$) )
FF 3130 DY = 365:DAY(2) = 28
76 3140 IF YEAR / 4 = INT (YEAR / 4) THEN DY = 366:D
    AY(2) = 29
E9 3150 RETURN
96 3160 REM READ
42 3170 HOME : VTAB 12: HTAB 16: PRINT "READING"
8D 3180 PRINT D$; "OPEN" + FILE$
53 3190 PRINT D$; "READ" + FILE$
69 3200 INPUT N
D2 3210 INPUT WD$(1),WD$(2)
39 3220 IF N = 0 THEN 3260
4D 3230 FOR I = 1 TO N
79 3240 INPUT K,MILES(K),TIME(K),LC$(K),CM$(K)
8B 3250 NEXT
EE 3260 PRINT D$; "CLOSE" + FILE$
F3 3270 RETURN
7C 3280 REM MENU
62 3290 HOME
38 3300 VTAB 7: HTAB 10: PRINT "WOULD YOU LIKE TO"
8B 3310 INVERSE
5E 3320 FOR I = 1 TO 4: VTAB I * 2 + 8: HTAB 11: PRI
    NT I: NEXT
4D 3330 NORMAL
73 3340 VTAB 10: HTAB 13: PRINT "LOG OR REVIEW A TRE
    K"

```

HOUSEHOLD HELPERS

```
8D 3350 VTAB 12: HTAB 13: PRINT "REVIEW MONTHLY FIGU
RES"
CF 3360 VTAB 14: HTAB 13: PRINT "TALLY YEARLY TOTALS
"
03 3370 VTAB 16: HTAB 13: PRINT "RETURN TO MAIN MENU
"
FD 3380 VTAB 19: HTAB 10: PRINT "=> ? ";BELL$;
80 3390 GET S$
52 3400 CHOICE = VAL (S$)
42 3410 IF CHOICE < 1 OR CHOICE > 4 THEN 3380
E3 3420 RETURN
13 3430 REM MONTHLY MILEAGE
85 3440 REM DRAW BOX & ENTER MONTH
15 3450 GOSUB 1950: GOSUB 2070
23 3460 REM DAY OF YEAR CORRESPONDING TO FIRST OF MO
NTH
AD 3470 D = 1: GOSUB 2310
48 3480 REM # DAYS FROM 1JAN78 (BASE DATE) TO FIRST
OF MONTH
B9 3490 GOSUB 3590
B8 3500 REM DAY OF THE WEEK (SUN=1 & SAT=7) THAT 1ST
IS ON
D3 3510 DW = ND - 7 * INT (ND / 7): IF DW = 0 THEN D
W = 7
5E 3520 REM DRAW SHELL
9F 3530 GOSUB 3680
FB 3540 REM LABEL
9B 3550 GOSUB 3760
95 3560 REM CHOOSE ACTION
BF 3570 GOSUB 3890
FD 3580 RETURN
55 3590 REM DAYS SINCE BASE DATE
B6 3600 ND = 0
1C 3610 FOR I = BY TO YEAR
AF 3620 INC = 365
54 3630 IF (I / 4) = INT (I / 4) THEN INC = 366
CB 3640 ND = ND + INC
C3 3650 NEXT
4F 3660 ND = ND - (INC - K)
FB 3670 RETURN
BA 3680 REM SHELL
6A 3690 HOME
A0 3700 S$ = ""
F1 3710 FOR I = 1 TO 36: S$ = S$ + CHR$ (45): NEXT
9A 3720 FOR R = 5 TO 17 STEP 3
A6 3730 VTAB R: HTAB 1: PRINT S$
C1 3740 NEXT
F5 3750 RETURN
08 3760 REM LABEL
3C 3770 C = 2: M$ = MT$(M): INVERSE
```

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```
F9 3780 FOR I = 1 TO 7
B8 3790 VTAB 1: HTAB C: PRINT DW$(I):C = C + 5
B3 3800 NEXT
AF 3810 FOR I = 1 TO LEN (M$)
CD 3820 VTAB I + 7: HTAB 38: PRINT MID$ (M$,I,1)
BF 3830 NEXT
AD 3840 VTAB 21: HTAB 1
BF 3850 FOR I = 1 TO 4
9B 3860 INVERSE : PRINT I;: NORMAL : PRINT C$(I); SP
      C( 3);
CF 3870 NEXT
04 3880 RETURN
CB 3890 REM ACTION
B1 3900 R = 4:C = DW: GOSUB 3990: REM DATES
91 3910 VTAB 23: HTAB 15: PRINT "CHOICE = ? ";BELL$;
70 3920 GET S$
8B 3930 ACTN = VAL (S$)
A9 3940 IF ACTN < 1 OR ACTN > 4 THEN 3910
04 3950 R = 4:C = DW
50 3960 ON ACTN GOSUB 3990,4110,4200
5F 3970 IF ACTN < > 4 THEN 3910
06 3980 RETURN
70 3990 REM DATES
C1 4000 FOR I = 1 TO DAY(M)
B5 4010 INVERSE : GOSUB 4070: NORMAL
F2 4020 VTAB R: HTAB 5 * C - 2: PRINT I
D6 4030 C = C + 1
B5 4040 IF C = 8 THEN R = R + 3:C = 1
B8 4050 NEXT
EC 4060 RETURN
13 4070 REM CLEAR BLOCK
E0 4080 VTAB R - 1: HTAB 5 * C - 3: PRINT SPC( 4)
14 4090 VTAB R: HTAB 5 * C - 3: PRINT SPC( 4)
D6 4100 RETURN
BD 4110 REM MILES
CB 4120 FOR I = 1 TO DAY(M)
BE 4130 MS = MILES(K + I - 1)
7F 4140 IF MS > 0 THEN NORMAL : GOSUB 4070: INVERSE
      : VTAB R: HTAB 5 * C - 3: PRINT INT (10 * MS
      + 0.5) / 10
E0 4150 C = C + 1
BF 4160 IF C = 8 THEN R = R + 3:C = 1
C2 4170 NEXT
5E 4180 NORMAL
FA 4190 RETURN
A2 4200 REM TIME
C9 4210 FOR I = 1 TO DAY(M)
94 4220 MS = MILES(K + I - 1):MIN = TIME(K + I - 1)
CF 4230 IF MS = 0 THEN 4270
2F 4240 NORMAL : GOSUB 4070: INVERSE
```

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```
7E 4250 IF MIN = 0 THEN VTAB R: HTAB 5 * C - 2: PRIN
    T "NA"
86 4260 IF MIN > 0 THEN GOSUB 4320
EA 4270 C = C + 1
C9 4280 IF C = 8 THEN R = R + 3: C = 1
CC 4290 NEXT
42 4300 NORMAL
DE 4310 RETURN
36 4320 REM MINUTES/MILE
21 4330 MM = MIN / MS: MN = INT (MM)
FA 4340 SC = INT ((MM - MN) * 60 + .5)
B0 4350 M$ = STR$ (MN) + " M": IF LEN (M$) = 3 THEN
    M$ = " " + M$
74 4360 S$ = STR$ (SC) + " S": IF LEN (S$) = 3 THEN
    S$ = " " + S$
49 4370 VTAB R - 1: HTAB 5 * C - 3: PRINT M$
BB 4380 VTAB R: HTAB 5 * C - 3: PRINT S$
FE 4390 RETURN
4E 4400 REM TOTALS
86 4410 GOSUB 1950
5B 4420 NORMAL : VTAB 2: HTAB 11: PRINT " MONTHLY MI
    LEAGE "
57 4430 TL = 0: CNT = 1
DA 4440 FOR I = 1 TO 12
84 4450 GOSUB 4540
B5 4460 VTAB I + 4: HTAB 5: PRINT MT$(I); TAB( 22) "="
    "; TAB( 35 - LEN (S$)); S$
92 4470 NEXT I
F4 4480 TL = INT (TL * 10 + .5) / 10
30 4490 S$ = STR$ (TL): IF INT (TL) = TL THEN S$ = S
    $ + ".0"
19 4500 VTAB 18: HTAB 5: INVERSE : PRINT "TOTAL": N
    ORMAL : PRINT TAB( 22) "="; TAB( 35 - LEN (S$
    )); S$
A6 4510 VTAB 22: HTAB 14: PRINT "PRESS ANY KEY "; BEL
    L$;
69 4520 GET S$
EA 4530 RETURN
2D 4540 REM SUM
77 4550 SUM = 0
60 4560 FOR J = 1 TO DAY(I)
3C 4570 SUM = SUM + MILES(CNT)
DF 4580 CNT = CNT + 1
9D 4590 NEXT J
B2 4600 SUM = INT (SUM * 10 + .5) / 10
2E 4610 S$ = STR$ (SUM): IF INT (SUM) = SUM THEN S$
    = S$ + ".0"
32 4620 TL = TL + SUM
EC 4630 RETURN
91 4640 REM SAVE DATA
```

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```
15 4650 : REM COUNT DAYS TO SAVE
FB 4660 HOME : VTAB 12: HTAB 16: PRINT "WORKING"
57 4670 N = 0
05 4680 FOR I = 1 TO DY
02 4690 IF MILES(I) < > 0 THEN N = N + 1
B2 4700 NEXT
7E 4710 VTAB 12: HTAB 14: PRINT "SAVING DATA"
5E 4720 : REM LOGBOOK
B6 4730 PRINT D$; "OPEN" + FILE$
F3 4740 PRINT D$; "WRITE" + FILE$
34 4750 PRINT N
89 4760 PRINT WD$(1); ", "; WD$(2)
03 4770 FOR I = 1 TO DY
2F 4780 IF MILES(I) < > 0 THEN PRINT I; ", "; MILES(I);
    ", "; TIME(I); ", "; LC$(I); ", "; CM$(I)
D6 4790 NEXT
26 4800 PRINT D$; "CLOSE"
32 4810 : REM CATALOG
FC 4820 PRINT D$; "OPEN EXCAT"
82 4830 PRINT D$; "WRITE EXCAT"
4D 4840 PRINT NF
3B 4850 FOR I = 1 TO NF
61 4860 PRINT FILE$(I)
D0 4870 NEXT
46 4880 PRINT D$; "CLOSE"
6F 4890 HOME
C0 4900 INVERSE : PRINT FILE$; : NORMAL : PRINT " IS
    SAVED."
EA 4910 RETURN
D4 4920 REM LOGBOOK NAMES
59 4930 HOME
55 4940 VTAB 1: HTAB 12: INVERSE : PRINT "LOGBOOKS O
    N FILE": NORMAL
3D 4950 FOR I = 1 TO NF
94 4960 VTAB I + 2: HTAB 16: PRINT FILE$(I)
D2 4970 NEXT
99 4980 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
8D 4990 GET S$
3C 5000 HOME
D9 5010 RETURN
14 5020 REM DELETE FILE
D2 5030 : REM ENTER NAME
73 5040 GOSUB 3060
EC 5050 : REM CHECK EXISTENCE
84 5060 DUP$ = "": GOSUB 1380
97 5070 IF DUP$ = "" THEN HOME : INVERSE : PRINT FIL
    E$; : NORMAL : PRINT " IS NOT ON FILE.": GOTO
    5160
72 5080 : REM DELETE IT
```


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```
05 5090 HOME : VTAB 12: HTAB 14: PRINT "DELETING DAT
A"
23 5100 PRINT D$;"DELETE " + FILE$
25 5110 : REM CATALOG
72 5120 IF NF = 1 THEN PRINT D$;"DELETE EXCAT"
3C 5130 IF NF > 1 THEN GOSUB 5170
F6 5140 NF = NF - 1
52 5150 HOME
EF 5160 RETURN
36 5170 REM REARRANGE
5C 5180 CNT = 0
3E 5190 FOR I = 1 TO NF
87 5200 IF FILE$(I) < > FILE$ THEN CNT = CNT + 1:FILE
E$(CNT) = FILE$(I)
AD 5210 NEXT
7B 5220 : REM RECORD
F5 5230 PRINT D$;"OPEN EXCAT"
7B 5240 PRINT D$;"WRITE EXCAT"
CE 5250 PRINT NF - 1
7B 5260 FOR I = 1 TO NF - 1
5A 5270 PRINT FILE$(I)
C9 5280 NEXT
3F 5290 PRINT D$;"CLOSE"
DB 5300 RETURN
```



CHAPTER 4

Stop, Look, and Learn

4

Stop, Look, and Learn

Text by John J. Flynn

Learning doesn't have to be hard. With the Apple it can be easy, as these educational and entertaining programs illustrate. In fact, using them is almost like playing a game. And while there's no pressure to get a right answer, the computer will reward you if you do.

The first four programs present some basic operations in math: how to count, add and subtract, multiply, and do fractions. The fifth program teaches your child how to tell time. And the sixth helps people of all ages learn a foreign language. Here's a quick look at the programs in this chapter.

Dancing Creatures. Bunnies and terrapins teach how to count to 20. Age group: preschoolers to second grade.

Let's Add and Subtract. The computer checks the student's skills in adding and subtracting integers. Numbers are drawn large for easier viewing. There's an easy level and a difficult one. Age group: first grade through mid-elementary school.

Let's Multiply. Youngsters get help with their basic times tables. There's an option to multiply numbers up to 1000, so older kids will like it, too. Age group: second grade and up. Adults can use the more difficult problems to sharpen rusty skills.

Fun with Fractions. Fractions don't have to be frustrating. With this program, students learn not just to add fractions, but to find common denominators as well. Age group: third grade and up.

Time to Tell. An easy method to teach the basics of telling time. There are three levels of play in this animated game where the clock hands actually move. Age group: first grade through mid-elementary school.

Foreign Language Flash Cards. A handy program that allows students to create their own vocabulary lists. The

STOP, LOOK, AND LEARN

computer then tests the students on the words and their meanings. Age group: first grade and up.

Programs 4-2 through 4-5 each draw objects on the screen using shapes from a binary file. This file is created by a shape file generator (Program 4-1), which you should enter and run first and only once. A shape file will be created on your disk for Programs 4-2 through 4-5 to read.

Program 4-1. Learning Programs Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
45 100 REM SHAPES FOR LEARNING PROGRAMS
7C 110 REM DIRECTORY
2B 120 DATA 22,0,46,0,238,0,138,1,32,2,210,2,34,3,95
    ,3,248,3,86,4
8B 130 DATA 132,4,214,4,43,5,110,5,197,5,30,6,89,6,1
    86,6,28,7,70,7
61 140 DATA 94,7,168,7,248,7
89 150 REM BUNNY 1
EA 160 DATA 32,36,36,39,44,37,36,36,36,44,44,52,54,5
    4,55,46,50,21,63,46
D9 170 DATA 53,63,46,63,63,60,36,45,36,36,7,32,59,23
    ,55,55,47,45,37,53
0F 180 DATA 61,54,62,46,46,46,54,63,62,62,55,55,63,6
    2,46,54,55,47,46,36
C0 190 DATA 44,37,39,45,36,37,37,45,46,44,44,52,46,4
    6,46,46,46,54,46,62
91 200 DATA 62,44,36,63,39,45,60,63,44,60,60,55,63,5
    5,55,45,44,53,55,63
CF 210 DATA 63,46,45,45,44,54,63,63,63,55,13,45,45,4
    5,21,31,55,53,45,40
1F 220 DATA 58,50,62,54,45,45,45,46,46,62,62,36,39,5
    5,46,62,60,36,55,62
94 230 DATA 36,55,39,36,36,37,63,54,54,62,59,62,63,6
    2,63,62,60,62,60,44
9A 240 DATA 44,46,36,53,46,36,53,38,37,53,37,45,60,6
    3,60,36,36,37,54,54
EE 250 DATA 53,45,60,60,36,45,53,61,38,63,7,0
94 260 REM BUNNY 2
D7 270 DATA 36,36,36,53,46,32,36,37,47,44,36,37,52,5
    5,55,62,39,60,60,52
82 280 DATA 53,54,62,63,50,41,44,46,45,13,36,37,37,3
    7,36,37,21,53,62,38
42 290 DATA 60,54,59,54,54,30,62,60,54,55,61,55,53,4
    6,54,55,54,45,52,54
55 300 DATA 49,46,54,46,46,46,54,39,39,63,44,63,44,4
    ,56,36,55,54,38,39
```


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16 310 DATA 36,44,39,39,60,47,54,46,62,56,60,55,54,5
5,62,60,44,60,39,39

8E 320 DATA 60,36,53,53,46,46,4,56,45,46,44,39,63,44
,44,38,45,45,44,39

CA 330 DATA 60,52,54,63,36,36,39,39,60,39,7,56,58,60
,60,36,37,62,62,63

3D 340 DATA 53,54,44,44,53,53,53,14,45,62,53,53,53,5
4,6,0

A7 350 REM TURTLE 1

61 360 DATA 37,37,36,36,37,45,45,4,40,37,37,60,60,60
,62,60,62,46,53,46

E9 370 DATA 37,31,63,46,46,62,39,55,63,39,55,39,23,6
2,62,62,46,62,62,46

27 380 DATA 62,46,62,46,62,46,46,62,53,31,43,42,45,5
2,54,55,54,53,45,37

B1 390 DATA 63,60,44,37,39,45,45,50,54,53,45,37,63,6
0,44,60,12,60,63,39

AC 400 DATA 45,45,37,63,63,63,40,45,45,37,61,63,63,6
3,44,9,41,45,60,63

B6 410 DATA 31,63,35,45,13,45,45,28,63,63,59,39,45,4
1,45,13,45,53,37,37

59 420 DATA 39,55,63,60,62,59,63,59,39,45,45,41,5,56
,63,63,39,45,45,45

97 430 DATA 60,63,63,44,45,45,60,63,7,0

B6 440 REM TURTLE 2

53 450 DATA 36,36,36,36,44,36,36,39,37,37,53,37,53,3
7,21,62,55,61,63,35

80 460 DATA 54,53,53,61,63,52,54,55,46,45,46,44,44,4
4,36,53,37,21,62,62

E3 470 DATA 52,55,55,61,62,52,55,55,46,54,54,62,54,5
5,46,21,54,55,46,62

28 480 DATA 39,36,39,45,60,63,58,32,37,37,44,36,37,3
6,39,36,60,60,54,53

96 490 DATA 55,53,55,45,62,54,55,62,62,54,62,54,54,4
5,62,63,60,44,60,44

D4 500 DATA 36,37,32,37,37,44,60,60,36,36,36,36,28,2
2,54,54,54,54,53,62

1B 510 DATA 62,54,58,54,39,36,37,36,37,61,36,36,36,4
,32,24,122,23,23

66 520 DATA 31,36,61,60,62,46,62,53,53,47,45,45,62,6
3,55,41,45,54,63,46

03 530 DATA 53,63,46,62,46,62,54,39,55,60,60,28,13,3
6,36,36,41,0

CC 540 REM DUCK 1

33 550 DATA 39,60,44,44,50,46,62,62,46,54,45,46,45,4
4,37,45,21,46,46,61

B4 560 DATA 39,63,62,60,63,62,55,39,23,23,39,44,39,3
9,60,36,60,36,61,36

A9 570 DATA 39,60,60,52,54,53,47,46,54,54,53,54,53,4
6,54,39,55,39,60,62

STOP, LOOK, AND LEARN

```

3E 580 DATA 36,61,55,62,60,39,63,45,45,37,44,45,38,6
    0,39,37,47,36,4,0
DA 590 REM DUCK 2
76 600 DATA 7,32,61,60,63,55,63,62,62,60,39,63,45,45
    ,37,45,44,45,45,53
9A 610 DATA 45,55,46,44,45,44,37,45,21,46,46,61,39,6
    3,62,60,63,62,55,63
5B 620 DATA 55,55,63,62,63,38,55,63,63,62,44,37,45,4
    4,36,37,45,44,53,5,0
39 630 REM BANNER
8B 640 DATA 36,55,54,55,62,36,44,36,60,54,63,36,37,6
    3,54,54,53,54,39,36
7E 650 DATA 31,36,36,37,63,54,54,22,46,62,39,36,4,32
    ,36,55,39,55,55,45
12 660 DATA 62,46,62,46,62,55,62,45,44,46,45,53,37,5
    3,53,37,45,52,53,63
2E 670 DATA 46,45,44,54,47,37,44,54,45,60,44,60,44,6
    3,63,39,44,46,44,46
64 680 DATA 36,60,63,36,53,37,53,53,36,53,22,45,4,56
    ,36,53,37,44,54,37
6D 690 DATA 36,45,44,52,62,54,54,31,63,46,53,55,53,6
    3,63,55,50,46,36,53
95 700 DATA 38,37,44,54,44,44,38,44,38,37,61,39,47,3
    7,39,45,45,12,45,12
50 710 DATA 45,45,53,41,53,41,45,45,37,41,12,45,0
8B 720 REM 0
14 730 DATA 9,9,49,54,54,62,62,62,63,63,39,39,39,36,
    36,36,36,36,44,44
60 740 DATA 44,45,45,53,53,53,54,54,53,54,54,54,62,6
    2,62,63,63,63,39,39
EC 750 DATA 39,36,36,36,36,36,36,44,44,44,45,45,45,5
    3,53,45,62,46,62,46
59 760 DATA 62,53,54,54,54,54,30,30,30,63,63,63,63,6
    0,60,60,36,36,36,36
5E 770 DATA 36,36,36,12,37,37,45,45,45,45,46,46,5,0
05 780 REM 1
26 790 DATA 55,54,54,54,62,63,54,37,53,37,53,37,53,4
    5,36,55,60,63,44,60
CC 800 DATA 44,60,44,60,44,36,36,36,36,36,60,54,54,5
    4,54,62,36,36,36,63
5B 810 DATA 39,41,37,39,41,0
3A 820 REM 2
0A 830 DATA 62,63,62,62,54,54,46,45,45,45,45,53,6
    2,60,62,60,62,60,62
87 840 DATA 60,62,60,62,60,62,39,37,39,37,39,37,39,3
    3,33,33,41,44,46,44
20 850 DATA 54,45,37,63,44,45,38,37,37,36,36,55,54,6
    2,38,36,36,44,28,28
07 860 DATA 63,63,63,63,46,45,45,53,38,63,63,63,6
    3,62,62,62,36,37,37

```

STOP, LOOK, AND LEARN

A0 870 DATA 4,0
 B6 880 REM 3
 F6 890 DATA 55,45,45,53,53,54,62,62,62,63,63,63,60,6
 0,55,53,47,46,52,46
 A2 900 DATA 44,46,44,46,44,46,44,46,44,60,45,60,45,6
 0,44,60,44,60,44,28
 A9 910 DATA 55,36,55,63,63,39,45,45,28,63,12,45,5,56
 ,39,41,45,56,39,41
 A7 920 DATA 37,36,63,63,63,63,63,63,63,46,45,45,45,4
 5,45,45,62,63,63,63
 CA 930 DATA 63,63,63,7,0
 BF 940 REM 4
 91 950 DATA 45,37,36,36,36,36,44,54,54,54,54,54,45,5
 3,62,60,62,60,54,53
 C0 960 DATA 54,54,54,63,44,60,44,60,44,60,36,36,36,3
 6,36,36,36,23,54,30
 2E 970 DATA 36,23,54,30,36,23,54,30,36,23,62,62,46,3
 7,46,45,53,45,62,63
 30 980 DATA 60,62,60,62,60,54,0
 0A 990 REM 5
 ED 1000 DATA 45,45,46,54,54,62,62,62,63,63,63,60,60,
 55,53,55,41,52,46,44
 B8 1010 DATA 46,44,46,44,46,44,46,44,60,45,60,45,60,
 44,60,44,60,44,28,39
 98 1020 DATA 39,55,39,55,39,63,63,46,45,62,63,39,36,
 36,36,44,45,45,45,45
 D9 1030 DATA 45,37,63,63,63,63,63,63,55,54,54,54,54,
 60,36,36,36,36,44,45
 23 1040 DATA 45,45,45,45,45,45,0
 24 1050 REM 6
 31 1060 DATA 45,45,46,46,46,54,54,55,55,55,63,63,63,
 63,60,60,60,36,36,36
 77 1070 DATA 45,45,45,53,37,53,37,46,46,46,62,46,55,
 55,55,39,55,39,55,39
 7F 1080 DATA 55,60,60,60,44,60,36,53,37,45,37,60,63,
 59,39,36,53,46,44,44
 41 1090 DATA 44,44,44,44,44,45,45,37,60,62,60,62,60,
 62,60,62,46,63,46,55
 51 1100 DATA 39,62,46,55,39,54,60,7,0
 96 1110 REM 7
 77 1120 DATA 62,62,62,54,54,54,62,39,37,39,37,39,37,
 39,37,37,37,37,37,53
 77 1130 DATA 46,32,37,63,12,45,38,37,63,12,45,38,37,
 63,44,37,60,63,63,63
 12 1140 DATA 63,63,63,55,45,45,45,45,45,45,61,55,63,
 63,63,63,63,0
 27 1150 REM 8
 72 1160 DATA 46,45,46,46,54,54,55,63,63,63,63,60,36,
 36,37,37,45,44,45,45

STOP, LOOK, AND LEARN

```

B4 1170 DATA 46,46,46,62,46,62,46,55,55,55,39,55,39,
    55,39,55,39,55,7,37
5A 1180 DATA 39,39,37,39,37,39,41,44,44,37,45,45,45,
    37,37,37,36,60,54,54
86 1190 DATA 55,63,37,12,36,60,44,37,59,60,63,63,63,
    55,45,45,45,53,63,63
3D 1200 DATA 63,55,39,60,50,55,54,46,36,44,54,46,46,
    62,39,63,0
99 1210 REM 9
C3 1220 DATA 60,63,60,60,36,36,37,45,45,45,45,46,54,
    54,55,55,63,62,63,63
42 1230 DATA 60,60,36,36,36,37,45,45,45,45,45,46,54,
    54,54,55,55,55,39,62
FA 1240 DATA 63,63,63,32,63,32,36,36,12,45,36,45,45,
    45,45,21,54,45,54,54
4E 1250 DATA 54,55,55,54,55,55,55,55,55,55,63,63,63,55,
    45,45,45,45,44,44,44
33 1260 DATA 44,44,36,44,52,54,54,51,59,62,62,62,62,
    63,63,63,63,0
AA 1270 REM +
26 1280 DATA 36,36,36,44,54,54,54,45,45,45,54,39,55,
    39,55,39,55,54,54,54
52 1290 DATA 63,44,60,44,60,44,60,63,63,63,36,53,37,
    53,37,53,37,36,36,36
CC 1300 DATA 4,0
95 1310 REM -
42 1320 DATA 45,45,45,53,63,63,63,63,60,62,60,62,60,
    62,36,45,45,45,45,45
E5 1330 DATA 45,45,5,0
37 1340 REM X
6F 1350 DATA 42,44,44,44,44,44,53,55,61,55,53,59,52,
    62,52,62,52,55,53,53
42 1360 DATA 53,53,53,53,62,39,61,60,38,39,37,63,38,
    39,61,60,62,62,62,62
C3 1370 DATA 62,62,39,37,47,44,38,44,38,44,38,44,38,
    37,37,39,60,60,60,60
F1 1380 DATA 60,55,53,47,46,52,46,52,46,52,46,52,54,
    0
A7 1390 REM BAR
56 1400 DATA 45,45,45,53,63,63,63,63,63,63,63,63,63,
    63,63,63,63,63,63,63
67 1410 DATA 63,63,63,63,63,63,63,63,39,45,45,45,45,
    45,45,45,45,45,45,45
07 1420 DATA 45,45,45,45,45,45,45,45,45,45,45,45,45,
    37,63,63,63,63,63
F6 1430 DATA 63,63,63,63,63,63,63,63,63,63,63,63,63,
    63,63,63,63,63,0
25 1440 REM CURSOR
EB 1450 DATA 4,40,49,51,49,58,56,58,32,32,51,50,42,0
63 1460 FOR I = 16384 TO 18437

```

STOP, LOOK, AND LEARN

```
0F 1470 READ V
DE 1480 POKE I,V
CD 1490 NEXT
8A 1500 PRINT CHR$(4);"BSAVE LEARN.SHAPE,A16384,L20
    54"
D0 1510 END
```

DANCING CREATURES

This introductory program helps preschoolers and first or second graders learn to count. It's easy to learn and uses high-resolution graphics to make counting fun.

The program displays a random number of either rabbits or terrapins on the screen—up to a total of 20 depending on the chosen limit. The child should count the number of times the particular creature appears and enter the value into the computer. The animals perform a little jig when the entry is right. When the answer is incorrect, the Apple displays the correct number of bunnies or terrapins.

"Dancing Creatures" introduces the concept of counting. For beginners, limit the total number of animals shown to three or four, then gradually increase this value. Bunnies and terrapins are used to keep the children's attention and to give them something easy and identifiable to tally. After mastering the rudiments of counting, the students can move on to the next program, "Let's Add and Subtract."

This program draws objects on the screen using shapes from a binary file. This file is created by a shape file generator (Program 4-1), which you should enter and run first and only once. A shape file will be created on your disk for this program to read. Then, whenever you want to use this program, just run Program 4-2. You don't have to run Program 4-1 again.

Program 4-2. Dancing Creatures

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
18 100 LOMEM: 18500
47 110 REM DANCING CREATURES
A8 120 REM INITIALIZE
47 130 GOSUB 240
50 140 REM PLAY GAME
4F 150 GOSUB 830
EC 160 REM PLAY AGAIN
62 170 TEXT : HOME
0F 180 VTAB 12: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
64 190 GET S$
D3 200 IF S$ = "Y" OR S$ = "y" THEN 150
01 210 IF S$ < > "N" AND S$ < > "n" THEN 180
```

STOP, LOOK, AND LEARN

```
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
AD 240 REM INITIALIZE
2D 250 REM TITLE
4F 260 GOSUB 340
8A 270 REM INSTRUCTIONS
4C 280 GOSUB 400
5A 290 REM VALUES
3E 300 GOSUB 500
F8 310 REM SHAPES
52 320 GOSUB 770
19 330 RETURN
2C 340 REM TITLE
2F 350 PRINT CHR$(21): TEXT : HOME
52 360 VTAB 12: HTAB 11: PRINT "DANCING CREATURES"
FE 370 FOR PAUSE = 1 TO 2000: NEXT
96 380 BELL$ = CHR$(7):Z = - 16336: REM CLICK
25 390 RETURN
7E 400 REM INSTRUCTIONS
49 410 HOME
13 420 VTAB 6: HTAB 13: PRINT "ONE, TWO"
CC 430 VTAB 8: HTAB 13: PRINT "BUCKLE MY SHOE ..."
63 440 VTAB 13: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
5F 450 GET S$
87 460 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 440
28 470 K1 = 3:K2 = 3
17 480 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
26 490 RETURN
4B 500 REM VALUES
0F 510 DIM X(20),Y(20),LN(57),PT(57)
30 520 K = 3: REM GAMES AT A TIME
03 530 CR$(1) = "BUNNIES":CR$(2) = "TERRAPINS"
78 540 : REM MUSIC MAKER
1A 550 DATA 172,27,3,174,27,3,232,208,253,169,4,32,1
    68,252,173,48,192,136,208,239,206,26,3,208,23
    1,96
AF 560 FOR I = 768 TO 793
D5 570 READ V: POKE I,V
0D 580 NEXT
F8 590 : REM NOTES FOR ALOUETTE
2D 600 DATA 6,151,2,166,4,177,4,177
7D 610 DATA 3,166,2,151,3,166,2,177,4,151,4,105
31 620 DATA 6,151,2,166,4,177,4,177
02 630 DATA 3,166,2,151,3,166,2,177,8,151
31 640 DATA 2,192,2,202,2,192,2,182,2,177,2,166,4,15
    1
18 650 DATA 2,192,2,192,4,192,2,105,2,105,4,105
1A 660 DATA 2,192,2,192,4,192,2,105,2,105,4,105
```


STOP, LOOK, AND LEARN

```
8B 670 FOR I = 1 TO 38
CD 680 READ LN(I),PT(I)
10 690 NEXT
7E 700 FOR I = 1 TO 19
C2 710 LN(I + 38) = LN(I):PT(I + 38) = PT(I)
03 720 NEXT
20 730 : REM NOTE GROUPS
21 740 DATA 19,38,57
29 750 FOR I = 1 TO 3: READ NTE(I): NEXT
23 760 RETURN
09 770 REM SHAPES
5A 780 HOME
AA 790 VTAB 12: HTAB 16: PRINT "READING"
0E 800 PRINT CHR$(4);"BLOAD LEARN.SHAPE"
95 810 POKE 233,64: POKE 232,0
1C 820 RETURN
9F 830 REM PLAY
5E 840 : REM CHOOSE CREATURE
DA 850 GOSUB 1030
3E 860 : REM CHOOSE HIGHEST NUMBER
F0 870 GOSUB 1170
4A 880 CNT = 0:NGP = 0
CB 890 FOR Q = 1 TO K
AC 900 : REM GET VALUES
D1 910 GOSUB 1310
29 920 : REM DRAW
D7 930 GOSUB 1600
4B 940 : REM GUESS
F7 950 GOSUB 1670
DA 960 ON (V = N) + 1 GOSUB 1730,1890
70 970 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
6A 980 GET S$
FB 990 NEXT Q
52 1000 : REM DISPLAY DUCK
1D 1010 IF CNT = K THEN GOSUB 2090
D9 1020 RETURN
45 1030 REM CHOOSE
03 1040 HOME : HGR : ROT= 0: SCALE= 1
66 1050 FOR I = 1 TO 3 STEP 2
CF 1060 X = 40 + 50 * I:Y = 70
D5 1070 HCOLOR= K1: DRAW I AT X,Y
ED 1080 DRAW INT (8.51 + I / 2) AT X,Y + 40
D4 1090 HCOLOR= K2
54 1100 HPLLOT X - 15,Y - 20 TO X + 15,Y - 20: HPLLOT
      TO X + 15,Y + 20: HPLLOT TO X - 15,Y + 20: HP
      LOT TO X - 15,Y - 20
71 1110 NEXT I
53 1120 VTAB 21: HTAB 8: PRINT "PLEASE CHOOSE A CREA
      TURE."
6F 1130 VTAB 23: HTAB 15: PRINT "NUMBER = ? ";;CLICK
      = PEEK (Z)
```

STOP, LOOK, AND LEARN

```
66 1140 GET S$
12 1150 C = VAL (S$): IF C < 1 OR C > 2 THEN 1130
EB 1160 RETURN
59 1170 REM HIGHEST NUMBER
7A 1180 TEXT : HOME
BE 1190 PRINT "PLEASE ENTER THE HIGHEST NUMBER OF"
F9 1200 PRINT CR$(C); " THAT YOU'D LIKE ME TO DRAW"
16 1210 PRINT "AT A TIME.": PRINT
DE 1220 PRINT "UP TO 20 ARE ALLOWED."
BD 1230 VTAB 7: HTAB 7: PRINT SPC( 15):CLICK = PEEK
    (Z)
40 1240 VTAB 7: HTAB 1: INPUT "=> ? ":S$
68 1250 HN = INT ( VAL (S$))
F1 1260 IF HN < 1 OR HN > 20 THEN 1230
OE 1270 VTAB 12: HTAB 1: PRINT "WE'LL PLAY ":K$: PRI
    NT " GAMES.  HAPPY COUNTING !"
86 1280 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
7C 1290 GET S$
D7 1300 RETURN
48 1310 REM VALUES
5F 1320 TEXT : HOME : VTAB 12: HTAB 16: PRINT "THINK
    ING"
EB 1330 FOR PAUSE = 1 TO 1000: NEXT PAUSE
30 1340 N = INT ( RND (1) * HN) + 1
B5 1350 : REM # OF ROWS
93 1360 NR = INT ((N - 1) / 5) + 1
BB 1370 : REM Y COORDINATES
E1 1380 FOR J = 1 TO N
FB 1390 R = INT ((J - 1) / 5) + 1
97 1400 IF NR = 1 THEN Y(J) = 80
CF 1410 IF NR = 2 THEN Y(J) = 64 * R - 17
06 1420 IF NR = 3 THEN Y(J) = 48 * R - 17
14 1430 IF NR = 4 THEN Y(J) = 39 * R - 17
84 1440 NEXT J
84 1450 : REM X COORDINATES
5B 1460 FOR I = 1 TO N
2A 1470 RW = INT ((I - 1) / 5) + 1
3D 1480 CL = I - (RW - 1) * 5
84 1490 X(I) = 51 * CL - 13
75 1500 NEXT I
88 1510 : REM CENTER LAST ROW
11 1520 E = NR * 5 - 4
3A 1530 FOR I = 1 TO CL
1E 1540 IF CL = 1 THEN X(E + I - 1) = 140
1B 1550 IF CL = 2 THEN X(E + I - 1) = 102 * I - 13
49 1560 IF CL = 3 THEN X(E + I - 1) = 76 * I - 13
C9 1570 IF CL = 4 THEN X(E + I - 1) = 61 * I - 13
95 1580 NEXT I
FF 1590 RETURN
DB 1600 REM DRAW
```

STOP, LOOK, AND LEARN

```
90 1610 HOME : HGR : ROT= 0: SCALE= 1: HCOLOR= K1
D0 1620 S(1) = 2 * C - 1: S(2) = S(1) + 1
53 1630 FOR I = 1 TO N
C1 1640 DRAW S(1) AT X(I),Y(I)
8B 1650 NEXT I
F5 1660 RETURN
29 1670 REM ASK
1E 1680 VTAB 22: HTAB 27: PRINT SPC( 10):CLICK = PEE
    K (Z)
E6 1690 VTAB 22: HTAB 16: INPUT "HOW MANY ? ";S$
1E 1700 V = INT ( VAL (S$))
81 1710 IF V < 1 THEN 1680
E7 1720 RETURN
A6 1730 REM WRONG
C2 1740 VTAB 24: HTAB 17: INVERSE : PRINT "SORRY";:
    NORMAL
03 1750 FOR I = 1 TO 150:CLICK = PEEK (Z): NEXT I
7F 1760 S$ = "THERE ARE " + STR$ (N) + CHR$ (32) + C
    R$(C) + "."
05 1770 FOR PAUSE = 1 TO 2000: NEXT PAUSE
ED 1780 VTAB 22: HTAB 21 - LEN (S$) / 2: PRINT S$
6D 1790 FOR I = 1 TO N
E1 1800 X = X(I):Y = Y(I)
1F 1810 HCOLOR= 0: DRAW S(1) AT X,Y
DC 1820 HCOLOR= 3
C3 1830 IF I < 10 THEN DRAW 8 + I AT X,Y
47 1840 IF I > 9 AND I < 20 THEN DRAW 9 AT X - 16,Y:
    DRAW 8 + (I - 10) AT X,Y
55 1850 IF I = 20 THEN DRAW 10 AT X - 18,Y: DRAW 8 A
    T X,Y
0C 1860 FOR PAUSE = 1 TO 1500: NEXT PAUSE
97 1870 NEXT I
02 1880 RETURN
75 1890 REM RIGHT
4F 1900 GOSUB 2020
1A 1910 VTAB 24: HTAB 15: INVERSE : PRINT "VERY GOOD
    !";: NORMAL
55 1920 FOR I = 1 TO N
EF 1930 X = X(I):Y = Y(I)
34 1940 FOR JUMPS = 1 TO 3
20 1950 FOR J = 1 TO 2
19 1960 HCOLOR= K1: DRAW S(J) AT X,Y
D7 1970 FOR PAUSE = 1 TO 125: NEXT PAUSE
54 1980 IF NOT (JUMPS = 3 AND J = 2) THEN HCOLOR= 0:
    DRAW S(J) AT X,Y
E1 1990 NEXT J,JUMPS,I
83 2000 CNT = CNT + 1
D6 2010 RETURN
67 2020 REM MUSIC
57 2030 NGP = NGP + 1: IF NGP = 4 THEN NGP = 1
F7 2040 F = NTE(NGP - 1) + 1:L = NTE(NGP)
```

STOP, LOOK, AND LEARN

```
5A 2050 FOR I = F TO L
71 2060 POKE 794, LN(I): POKE 795, PT(I): CALL 768
88 2070 NEXT I
F2 2080 RETURN
31 2090 REM PERFECT SCORE
75 2100 CALL - 3086
AC 2110 DUCK = 5: YD(5) = 108: YD(6) = 101
FF 2120 VTAB 22: HTAB 10: PRINT "YOU GOT ALL "; K; " R
    IGH T !"
22 2130 VTAB 24: HTAB 14: PRINT SPC( 13);
B9 2140 : REM FLIGHT
C2 2150 FOR X = 70 TO 265 STEP 3
60 2160 HCOLOR= K1: DRAW DUCK AT X, 100: HCOLOR= 3: D
    RAW 7 AT X - 54, YD(DUCK)
B4 2170 FOR PAUSE = 1 TO 120: NEXT PAUSE
89 2180 HCOLOR= 0: DRAW DUCK AT X, 100: DRAW 7 AT X -
    54, YD(DUCK)
93 2190 DUCK = 11 - DUCK
7F 2200 NEXT X
DA 2210 RETURN
```

LET'S ADD AND SUBTRACT

This addition and subtraction game is a bit more advanced than Dancing Creatures. Instead of counting images and entering the number of creatures into the computer, children are challenged with some simple additions and subtractions using integers.

Since young students may have difficulty in carrying over numbers from one column to the next, this program gives them a chance to work with either simple problems (without carrying) or more complex ones (with carrying).

When entering their answers, children key in the number in the right-hand column first, just as in school with pencil and paper. If the answer is 12, for example, they should type 2 first, then 1.

This program draws objects on the screen using shapes from a binary file. This file is created by a shape file generator (Program 4-1), which you should enter and run first and only once. A shape file will be created on your disk for this program to read. Then, whenever you want to use this program, just run Program 4-3. You don't have to run Program 4-1 again.

Program 4-3. Let's Add and Subtract

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
1B 100 LOMEM: 18500
A3 110 REM LET'S ADD & SUBTRACT
A8 120 REM INITIALIZE
47 130 GOSUB 240
9A 140 REM PLAY
C9 150 GOSUB 1100
EC 160 REM PLAY AGAIN
62 170 TEXT : HOME
0F 180 VTAB 12: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
64 190 GET S$
D3 200 IF S$ = "Y" OR S$ = "y" THEN 150
01 210 IF S$ < > "N" AND S$ < > "n" THEN 180
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
AD 240 REM INITIALIZE
```

STOP, LOOK, AND LEARN

```
4F 250 : REM TITLE
57 260 GOSUB 380
6A 270 : REM INSTRUCTIONS (PAGE 1)
54 280 GOSUB 440
6F 290 : REM INSTRUCTIONS (PAGE 2)
4A 300 GOSUB 560
9D 310 : REM TYPE MONITOR
53 320 GOSUB 680
96 330 : REM VALUES
54 340 GOSUB 760
F5 350 : REM SHAPES
DB 360 GOSUB 1040
21 370 RETURN
34 380 REM TITLE
37 390 PRINT CHR$ (21): TEXT : HOME
D0 400 VTAB 12: HTAB 10: PRINT "LET'S ADD & SUBTRACT
"
F3 410 FOR PAUSE = 1 TO 2000: NEXT
8B 420 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
1A 430 RETURN
BC 440 REM PAGE 1
51 450 HOME
04 460 PRINT "I'LL MAKE UP SOME NICE ADDITION AND"
D7 470 PRINT "SUBTRACTION PROBLEMS FOR YOU.": PRINT
78 480 PRINT "PLEASE ENTER YOUR ANSWERS JUST AS YOU"
7A 490 PRINT "DERIVE THEM: FROM RIGHT TO LEFT."
7B 500 VTAB 8: HTAB 1: PRINT "IN THE PROBLEM": VTAB
10: HTAB 19: PRINT "7": VTAB 11: HTAB 18: PRI
NT "+3": VTAB 12: HTAB 17: PRINT "----": VTAB
13: HTAB 18: PRINT "10"
AC 510 VTAB 12: HTAB 23: PRINT ", FOR EXAMPLE,"
CE 520 VTAB 15: HTAB 10: PRINT "ENTER ";; INVERSE :
PRINT "0";; NORMAL : PRINT " AND THEN ";; INV
ERSE : PRINT "1";; NORMAL : PRINT "."
63 530 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
5E 540 GET S$
1F 550 RETURN
C5 560 REM PAGE 2
56 570 HOME
DB 580 PRINT "'PLACE CARRYING' IS SOMETIMES REQUIRED
"
E9 590 PRINT "IN ADDITION AND SUBTRACTION.": PRINT
0B 600 VTAB 5: HTAB 1: PRINT "IN THE PROBLEM": VTAB
7: HTAB 19: PRINT "14": VTAB 8: HTAB 19: PRIN
T "+8": VTAB 9: HTAB 18: PRINT "----": VTAB 10
: HTAB 19: PRINT "22"
D2 610 VTAB 9: HTAB 23: PRINT ", FOR EXAMPLE,"
11 620 VTAB 12: HTAB 5: INVERSE : PRINT "1";; NORMAL
: PRINT " IS CARRIED IN THE TENS PLACE."
```


STOP, LOOK, AND LEARN

```
27 630 VTAB 16: HTAB 1: PRINT "I'LL AVOID THIS KIND
    OF PROBLEM, IF"
84 640 PRINT "YOU'D LIKE."
68 650 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
63 660 GET S$
24 670 RETURN
E1 680 REM TYPE MONITOR
58 690 HOME
5D 700 VTAB 12: HTAB 1: PRINT "ARE YOU USING A COLOR
    MONITOR (Y/N) ? ";BELL$;
5A 710 GET S$
41 720 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
    ND S$ < > "n" THEN 700
23 730 K1 = 3:K2 = 3
12 740 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
21 750 RETURN
59 760 REM VALUES
7B 770 DIM LN(57),PT(57)
21 780 K = 5: REM PROBLEMS IN A SET
84 790 : REM MUSIC MAKER
13 800 DATA 172,27,3,174,27,3,232,208,253,169,4,32,1
    68,252,173,48,192,136,208,239,206,26,3,208,23
    1,96
A8 810 FOR I = 768 TO 793
CE 820 READ V: POKE I,V
06 830 NEXT
F1 840 : REM NOTES FOR ALOUETTE
39 850 DATA 6,151,2,166,4,177,4,177
89 860 DATA 3,166,2,151,3,166,2,177,4,151,4,105
3D 870 DATA 6,151,2,166,4,177,4,177
0E 880 DATA 3,166,2,151,3,166,2,177,8,151
3D 890 DATA 2,192,2,202,2,192,2,182,2,177,2,166,4,15
    1
11 900 DATA 2,192,2,192,4,192,2,105,2,105,4,105
13 910 DATA 2,192,2,192,4,192,2,105,2,105,4,105
84 920 FOR I = 1 TO 38
C6 930 READ LN(I),PT(I)
09 940 NEXT
8A 950 FOR I = 1 TO 19
CE 960 LN(I + 38) = LN(I):PT(I + 38) = PT(I)
0F 970 NEXT
2C 980 : REM NOTE GROUPS
7C 990 DATA 10,19,38,48,57
02 1000 FOR I = 1 TO 5: READ NTE(I): NEXT
01 1010 : REM MENU
15 1020 M$(1) = "ADD":M$(2) = "SUBTRACT"
DD 1030 RETURN
A9 1040 REM SHAPES
4C 1050 HOME
EC 1060 VTAB 12: HTAB 16: PRINT "READING"
```

STOP, LOOK, AND LEARN

```
09 1070 PRINT CHR$(4); "BLOAD LEARN.SHAPE"
E8 1080 POKE 233,64: POKE 232,0
F5 1090 RETURN
D6 1100 REM PLAY
54 1110 : REM CHOOSE CREATURE
61 1120 GOSUB 1340
11 1130 : REM CHOOSE TYPE OF PROBLEM
80 1140 GOSUB 1480
1C 1150 : REM CHOOSE HIGHEST NUMBER
85 1160 GOSUB 1650
34 1170 CNT = 0:NGP = 0
31 1180 FOR Q = 1 TO K
1F 1190 : REM GET VALUES
93 1200 GOSUB 1790
F1 1210 : REM DRAW
65 1220 GOSUB 2150
30 1230 : REM GUESS
55 1240 GOSUB 2310
8E 1250 GUESS = VAL (G$)
8D 1260 VTAB 21: HTAB 8: PRINT SPC( 24): VTAB 23: HT
    AB 11: PRINT SPC( 17)
EC 1270 ON (GUESS = AW) + 1 GOSUB 2540,2580
86 1280 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
7C 1290 GET S$
79 1300 NEXT Q
5C 1310 : REM DISPLAY DUCK
C7 1320 IF CNT = K THEN GOSUB 2780
E3 1330 RETURN
E1 1340 REM CREATURE
0D 1350 HOME : HGR : ROT= 0: SCALE= 1
70 1360 FOR I = 1 TO 3 STEP 2
09 1370 X = 40 + 50 * I:Y = 70
DF 1380 HCOLOR= K1: DRAW I AT X,Y
F7 1390 DRAW INT (8.51 + I / 2) AT X,Y + 40
BB 1400 HCOLOR= K2
5E 1410 HPLLOT X - 15,Y - 20 TO X + 15,Y - 20: HPLLOT
    TO X + 15,Y + 20: HPLLOT TO X - 15,Y + 20: HP
    LOT TO X - 15,Y - 20
7B 1420 NEXT I
5D 1430 VTAB 21: HTAB 8: PRINT "PLEASE CHOOSE A CREA
    TURE."
79 1440 VTAB 23: HTAB 15: PRINT "NUMBER = ? ";:CLICK
    = PEEK (Z)
70 1450 GET S$
BC 1460 C = VAL (S$): IF C < 1 OR C > 2 THEN 1440
F5 1470 RETURN
4C 1480 REM OPTIONS
84 1490 TEXT : HOME
9C 1500 : REM ADD OR SUBTRACT
BF 1510 VTAB 7: HTAB 13: PRINT "WOULD YOU LIKE TO"
```

STOP, LOOK, AND LEARN

```
88 1520 FOR I = 1 TO 2
60 1530 VTAB I * 2 + 7: HTAB 15: INVERSE : PRINT I;:
    NORMAL : PRINT CHR$ (32);M$(I)
88 1540 NEXT
01 1550 VTAB 13: HTAB 15: PRINT "=> ? ";:CLICK = PE
    EK (Z)
76 1560 GET S$
25 1570 PICK = VAL (S$): IF PICK < 1 OR PICK > 2 THE
    N 1550
C2 1580 : REM PLACE CARRYING
A9 1590 VTAB 16: HTAB 5: PRINT "AVOID 'PLACE CARRYIN
    G' (Y/N) ? ";:CLICK = PEEK (Z)
60 1600 GET S$
49 1610 A = ASC (S$): IF A > 96 THEN A = A - 32
E6 1620 S$ = CHR$ (A): IF S$ < > "Y" AND S$ < > "N"
    THEN 1590
1E 1630 PC$ = S$
ED 1640 RETURN
5B 1650 REM HIGHEST NUMBER
5C 1660 HOME
8B 1670 PRINT "PLEASE ENTER THE HIGHEST NUMBER THAT"
63 1680 PRINT "YOU'D LIKE ME TO USE (1 TO 1000). "
0B 1690 VTAB 5: HTAB 7: PRINT SPC( 15):CLICK = PEEK
    (Z)
3B 1700 VTAB 5: HTAB 1: INPUT "=> ? ";S$
62 1710 HN = INT ( VAL (S$))
9F 1720 IF HN < 1 OR HN > 1000 THEN 1690
CF 1730 VTAB 12: HTAB 8: PRINT "I'LL GIVE YOU ";K;"
    PROBLEMS."
81 1740 S$ = "HAPPY " + M$(PICK) + "ING !"
0F 1750 VTAB 14: HTAB 21 - LEN (S$) / 2: INVERSE : P
    RINT S$: NORMAL
8B 1760 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
7E 1770 GET S$
FF 1780 RETURN
70 1790 REM VALUES
51 1800 TEXT : HOME : VTAB 12: HTAB 16: PRINT "THINK
    ING"
ED 1810 FOR PAUSE = 1 TO 1000: NEXT PAUSE
14 1820 : REM GET NUMBERS
95 1830 FOR I = 1 TO 2
53 1840 N(I) = INT ( RND (1) * HN) + 1
8F 1850 NEXT I
59 1860 IF N(2) > N(1) THEN 1830
73 1870 : REM DIGITS
67 1880 GOSUB 1970
4A 1890 : REM CHECK FOR PLACE CARRYING
37 1900 P$ = "OKAY"
86 1910 ON PICK GOSUB 2050,2100
6B 1920 IF PC$ = "Y" AND P$ = "BAD" THEN 1830
```

STOP, LOOK, AND LEARN

```
FR 1930 : REM ANSWER
43 1940 IF PICK = 1 THEN AW = N(1) + N(2)
50 1950 IF PICK = 2 THEN AW = N(1) - N(2)
FR 1960 RETURN
A9 1970 REM DIGITS
AB 1980 FOR I = 1 TO 2
BB 1990 S$ = STR$ (N(I)):L(I) = LEN (S$)
85 2000 S$ = RIGHT$ ("000" + S$,4)
IF 2010 FOR J = 1 TO 4
77 2020 D(I,J) = VAL ( MID$ (S$,5 - J,1))
F9 2030 NEXT J,I
E2 2040 RETURN
9F 2050 REM +
33 2060 FOR J = 1 TO 4
E0 2070 IF D(1,J) + D(2,J) > 9 THEN P$ = "BAD"
8D 2080 NEXT J
F6 2090 RETURN
8E 2100 REM -
21 2110 FOR J = 1 TO 4
4E 2120 IF D(1,J) - D(2,J) < 0 THEN P$ = "BAD"
7B 2130 NEXT J
E4 2140 RETURN
E3 2150 REM DRAW
0E 2160 HOME : HGR : ROT= 0: SCALE= 1
9E 2170 : REM BOX
E7 2180 HCOLOR= 3
12 2190 HPLLOT 5,5 TO 274,5: HPLLOT TO 274,149: HPLLOT
    TO 5,149: HPLLOT TO 5,5
21 2200 HPLLOT 6,6 TO 273,6: HPLLOT TO 273,148: HPLLOT
    TO 6,148: HPLLOT TO 6,6
87 2210 : REM PROBLEM
86 2220 FOR I = 1 TO 2
44 2230 X = 158:Y = 30 + 25 * I
0D 2240 FOR J = 1 TO L(I)
6B 2250 DRAW 8 + D(I,J) AT X,Y
ED 2260 X = X - 18
0E 2270 NEXT J,I
CA 2280 DRAW 17 + PICK AT X,Y
CB 2290 DRAW 21 AT 158,96
DB 2300 RETURN
F2 2310 REM GUESS
1A 2320 VTAB 21: HTAB 8: PRINT "PLEASE ENTER YOUR AN
    SWER"
01 2330 VTAB 23: HTAB 11: PRINT "THEN HIT ";: INVERS
    E : PRINT "<RETURN>": NORMAL
80 2340 X = 158:Y = 112
EA 2350 G$ = ""
DC 2360 DRAW 22 AT X,Y
51 2370 : REM ENTER DIGIT
7C 2380 GOSUB 2430
```

STOP, LOOK, AND LEARN

```
48 2390 HCOLOR= 0: DRAW 22 AT X,Y
64 2400 IF A = 21 THEN GOSUB 2490: GOTO 2360: REM MO
    VE RIGHT
72 2410 IF A < > 13 THEN DIGIT = A - 48: HCOLOR= 3:
    DRAW 8 + DIGIT AT X,Y:X = X - 18:G$ = STR$ (
    DIGIT) + G$: GOTO 2360
E2 2420 RETURN
D2 2430 REM ENTER
D9 2440 P = PEEK ( - 16384): IF P < 128 THEN 2440
E4 2450 POKE - 16368,0
55 2460 A = P - 128
8A 2470 IF NOT (A = 13 OR (A = 21 AND G$ < > "") OR
    (A > 47 AND A < 58)) THEN CLICK = PEEK (Z):
    GOTO 2440
FA 2480 RETURN
26 2490 REM MOVE RIGHT
CC 2500 S$ = LEFT$ (G$,1):G$ = MID$ (G$,2):V = ASC (
    S$) - 48
3C 2510 X = X + 18: DRAW 8 + V AT X,Y: HCOLOR= 3
68 2520 CLICK = PEEK (Z)
E8 2530 RETURN
A7 2540 REM WRONG
FF 2550 FOR I = 1 TO 150:CLICK = PEEK (Z): NEXT I
ED 2560 VTAB 21: HTAB 1: INVERSE : PRINT "SORRY:";:
    NORMAL : PRINT " THE ANSWER IS ";AW;". "
F8 2570 RETURN
6C 2580 REM RIGHT
2D 2590 VTAB 21: HTAB 15: INVERSE : PRINT "VERY GOOD
    !";: NORMAL
5E 2600 GOSUB 2710
D4 2610 X = 220:Y = 80
DE 2620 S(1) = 2 * C - 1:S(2) = S(1) + 1
2B 2630 FOR JUMPS = 1 TO 3
17 2640 FOR J = 1 TO 2
10 2650 HCOLOR= K1: DRAW S(J) AT X,Y
CE 2660 FOR PAUSE = 1 TO 125: NEXT PAUSE
4B 2670 IF NOT (JUMPS = 3 AND J = 2) THEN HCOLOR= 0:
    DRAW S(J) AT X,Y
B8 2680 NEXT J,JUMPS
E3 2690 CNT = CNT + 1
E0 2700 RETURN
71 2710 REM MUSIC
81 2720 NGP = NGP + 1: IF NGP = 6 THEN NGP = 1
02 2730 F = NTE(NGP - 1) + 1:L = NTE(NGP)
64 2740 FOR I = F TO L
7B 2750 POKE 794,LN(I): POKE 795,PT(I): CALL 768
92 2760 NEXT I
FC 2770 RETURN
3B 2780 REM PERFECT SCORE
A5 2790 CALL - 3086
```

STOP, LOOK, AND LEARN

```
B6 2800 DUCK = 5: YD(5) = 108: YD(6) = 101
08 2810 VTAB 21: HTAB 10: PRINT "YOU GOT ALL "; K; " R
    IGH T !"
2A 2820 VTAB 23: HTAB 14: PRINT SPC( 13):
C3 2830 : REM FLIGHT
CC 2840 FOR X = 70 TO 265 STEP 3
7A 2850 HCOLOR= K2: DRAW DUCK AT X, 100: HCOLOR= 3: D
    RAW 7 AT X - 54, YD(DUCK)
BE 2860 FOR PAUSE = 1 TO 120: NEXT PAUSE
93 2870 HCOLOR= 0: DRAW DUCK AT X, 100: DRAW 7 AT X -
    54, YD(DUCK)
9D 2880 DUCK = 11 - DUCK
AF 2890 NEXT X
E4 2900 RETURN
```


LET'S MULTIPLY

Many people have trouble with multiplication tables when they are learning math for the first time. Since practice is the best method for both learning and understanding how to multiply, this program will be of value in gaining this important basic skill.

As in the previous program, all answers should be entered as they are derived. For example, the result for $4 \times 3 = ?$ would be 12; first, enter the 2 and then the 1.

Students can practice almost any integer problem they like. Acceptable values for the first multiplier range from 1 to 9, but the second multiplier can be up to 1000. Children and adults can thus practice the easier low numbers and advance to more complicated problems once they gain experience. "Let's Multiply" allows you to sharpen skills that become dull from repeated use of calculators.

This program draws objects on the screen using shapes from a binary file. This file is created by a shape file generator (Program 4-1), which you should enter and run first and only once. A shape file will be created on your disk for this program to read. Then, whenever you want to use this program, just run Program 4-4. You don't have to run Program 4-1 again.

Program 4-4. Let's Multiply

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
1B 100 LOMEM: 18500
5F 110 REM LET'S MULTIPLY
AB 120 REM INITIALIZE
47 130 GOSUB 240
9A 140 REM PLAY
58 150 GOSUB 970
EC 160 REM PLAY AGAIN
62 170 TEXT : HOME
0F 180 VTAB 12: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
64 190 GET S$
D3 200 IF S$ = "Y" OR S$ = "y" THEN 150
01 210 IF S$ < > "N" AND S$ < > "n" THEN 180
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
```

STOP, LOOK, AND LEARN

```
AD 240 REM INITIALIZE
4F 250 : REM TITLE
53 260 GOSUB 360
9D 270 : REM VALUES
4E 280 GOSUB 410
0A 290 : REM INSTRUCTIONS
42 300 GOSUB 710
9D 310 : REM TYPE MONITOR
4B 320 GOSUB 830
F1 330 : REM SHAPES
4C 340 GOSUB 910
1D 350 RETURN
30 360 REM TITLE
33 370 PRINT CHR$(21): TEXT : HOME
60 380 VTAB 12: HTAB 13: PRINT "LET'S MULTIPLY"
87 390 FOR PAUSE = 1 TO 1500: NEXT
14 400 RETURN
4C 410 REM VALUES
8B 420 BELL$ = CHR$(7):Z = - 16336: REM CLICK
40 430 DIM LN(113),PT(113)
16 440 K = 5: REM PROBLEMS IN A SET
79 450 : REM MUSIC MAKER
1B 460 DATA 172,27,3,174,27,3,232,208,253,169,4,32,1
68,252,173,48,192,136,208,239,206,26,3,208,23
1,96
80 470 FOR I = 768 TO 793
D6 480 READ V: POKE I,V
0E 490 NEXT
3C 500 : REM DIXIE
CA 510 DATA 1,151,1,125,2,85,2,85,1,85,1,105,1,125,1
,134,2,151,2,151
8D 520 DATA 2,151,2,125,2,166,2,166,2,166,2,151,2,16
6,2,151,1,166,1,177
06 530 DATA 1,182,1,192,6,202,1,182,1,151,6,182,1,15
1,1,125,6,151,1,105
3F 540 DATA 1,125,4,85,1,151,1,151,2,182,2,202,2,192
,2,182,2,166,4,182
54 550 DATA 2,166,6,192,2,166,6,192,2,151,2,182,2,20
2,2,192,2,182,2,166
51 560 DATA 2,177,2,182,2,166,2,151,2,125,2,182,2,12
5,2,125,4,105,2,125
58 570 DATA 6,85,2,125,6,105,2,166,2,151,2,125,2,182
,2,202,2,192,4,182
0F 580 DATA 2,125,6,85,2,125,6,105,2,166,2,151,2,125
,2,202,2,182,2,192
1C 590 DATA 4,182
1D 600 FOR I = 1 TO 32
BF 610 READ LN(I),PT(I)
B1 620 LN(I + 32) = LN(I):PT(I + 32) = PT(I)
04 630 NEXT
```

STOP, LOOK, AND LEARN

```
F3 640 FOR I = 65 TO 113
C7 650 READ LN(I),PT(I)
0A 660 NEXT
27 670 : REM NOTE GROUPS
E4 680 DATA 32,64,91,102,113
40 690 FOR I = 1 TO 5: READ NTE(I): NEXT
17 700 RETURN
83 710 REM INSTRUCTIONS
4E 720 HOME
9B 730 PRINT "LET'S LEARN TO MULTIPLY WITH MR. BUNNY
"
77 740 PRINT "AND MR. TERRAPIN.": PRINT
75 750 PRINT "PLEASE ENTER YOUR ANSWERS JUST AS YOU"
77 760 PRINT "DERIVE THEM: FROM RIGHT TO LEFT."
CC 770 VTAB 8: HTAB 1: PRINT "IN THE PROBLEM": VTAB
10: HTAB 19: PRINT "7": VTAB 11: HTAB 18: PRI
NT "#3": VTAB 12: HTAB 17: PRINT "----": VTAB
13: HTAB 18: PRINT "21"
BC 780 VTAB 12: HTAB 23: PRINT ", FOR EXAMPLE,"
3F 790 VTAB 15: HTAB 10: PRINT "ENTER ";; INVERSE :
PRINT "1";; NORMAL : PRINT " AND THEN ";; INV
ERSE : PRINT "2";; NORMAL : PRINT "."
60 800 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
5B 810 GET S$
1C 820 RETURN
4C 830 REM MONITOR
53 840 HOME
6B 850 VTAB 12: HTAB 1: PRINT "ARE YOU USING A COLOR
MONITOR (Y/N) ? ";BELL$;
65 860 GET S$
0F 870 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
ND S$ < > "n" THEN 850
2E 880 K1 = 3:K2 = 3
1D 890 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
19 900 RETURN
FE 910 REM SHAPES
50 920 HOME
A0 930 VTAB 12: HTAB 16: PRINT "READING"
17 940 PRINT CHR$(4);"BLOAD LEARN.SHAPE"
9E 950 POKE 233,64: POKE 232,0
25 960 RETURN
A8 970 REM PLAY
67 980 : REM CHOOSE CREATURE
DF 990 GOSUB 1210
4B 1000 : REM NUMBER TO PRACTICE
63 1010 GOSUB 1350
19 1020 : REM 2ND NUMBER
8F 1030 GOSUB 1450
26 1040 CNT = 0:NGP = 0
23 1050 FOR Q = 1 TO K
```

STOP, LOOK, AND LEARN

```
11 1060 : REM GET VALUES
93 1070 GOSUB 1570
9A 1080 : REM DRAW
7B 1090 GOSUB 1720
22 1100 : REM GUESS
91 1110 GOSUB 1880
8B 1120 GUESS = VAL (G$)
7F 1130 VTAB 21: HTAB 8: PRINT SPC( 24): VTAB 23: HT
    AB 11: PRINT SPC( 17)
93 1140 ON (GUESS = AW) + 1 GOSUB 2110,2150
7B 1150 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
6E 1160 GET S$
91 1170 NEXT Q
74 1180 : REM DISPLAY DUCK
9E 1190 IF CNT = K THEN GOSUB 2350
05 1200 RETURN
03 1210 REM CREATURE
FE 1220 HOME : HGR : ROT= 0: SCALE= 1
62 1230 FOR I = 1 TO 3 STEP 2
CB 1240 X = 40 + 50 * I:Y = 70
D1 1250 HCOLOR= K1: DRAW I AT X,Y
E9 1260 DRAW INT (8.51 + I / 2) AT X,Y + 40
D8 1270 HCOLOR= K2
76 1280 HPLLOT X - 15,Y - 20 TO X + 15,Y - 20: HPLLOT
    TO X + 15,Y + 20: HPLLOT TO X - 15,Y + 20: HP
    LOT TO X - 15,Y - 20
93 1290 NEXT I
4F 1300 VTAB 21: HTAB 8: PRINT "PLEASE CHOOSE A CREA
    TURE."
6B 1310 VTAB 23: HTAB 15: PRINT "NUMBER = ? ";:CLICK
    = PEEK (Z)
62 1320 GET S$
CD 1330 C = VAL (S$): IF C < 1 OR C > 2 THEN 1310
E7 1340 RETURN
97 1350 REM NUMBER TO PRACTICE
76 1360 TEXT : HOME
91 1370 PRINT "PLEASE ENTER THE NUMBER THAT YOU'D LI
    KE"
EE 1380 PRINT "TO PRACTICE MULTIPLYING (1 TO 9). "
DC 1390 VTAB 5: HTAB 1: PRINT "==" ? ";:CLICK = PEEK
    (Z)
5C 1400 GET S$
C6 1410 N(2) = VAL (S$)
62 1420 IF N(2) < 1 OR N(2) > 9 THEN 1390
8F 1430 PRINT S$
E9 1440 RETURN
7C 1450 REM 2ND NUMBER
44 1460 VTAB 8: HTAB 1: PRINT "PLEASE ENTER THE HIGH
    EST 'OTHER' NUMBER"
5B 1470 PRINT "YOU'D LIKE ME TO USE (1 TO 1000). "
```

STOP, LOOK, AND LEARN

```
F3 1480 VTAB 11: HTAB 7: PRINT SPC( 15):CLICK = PEEK
      (Z)
F4 1490 VTAB 11: HTAB 1: INPUT "=> ? ";S$
5A 1500 HN = INT ( VAL (S$))
93 1510 IF HN < 1 OR HN > 1000 THEN 1480
C0 1520 VTAB 15: HTAB 8: PRINT "I'LL GIVE YOU ";K;"
      PROBLEMS."
D2 1530 VTAB 17: HTAB 11: INVERSE : PRINT "HAPPY MUL
      TIPLYING !": NORMAL
7C 1540 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
72 1550 GET S$
F3 1560 RETURN
64 1570 REM VALUES
57 1580 N(1) = INT ( RND (1) * HN) + 1
75 1590 : REM DIGITS
6F 1600 GOSUB 1640
ED 1610 : REM ANSWER
EB 1620 AW = N(1) * N(2)
E9 1630 RETURN
97 1640 REM DIGITS
99 1650 FOR I = 1 TO 2
A9 1660 S$ = STR$ (N(I)):L(I) = LEN (S$)
AC 1670 S$ = RIGHT$ ("000" + S$,4)
46 1680 FOR J = 1 TO 4
9E 1690 D(I,J) = VAL ( MID$ (S$,5 - J,1))
FA 1700 NEXT J,I
E3 1710 RETURN
E2 1720 REM DRAW
8D 1730 HOME : HGR : ROT= 0: SCALE= 1
9D 1740 : REM BOX
E6 1750 HCOLOR= 3
11 1760 HPLLOT 5,5 TO 274,5: HPLLOT TO 274,149: HPLLOT
      TO 5,149: HPLLOT TO 5,5
46 1770 HPLLOT 6,6 TO 273,6: HPLLOT TO 273,148: HPLLOT
      TO 6,148: HPLLOT TO 6,6
AC 1780 : REM PROBLEM
AB 1790 FOR I = 1 TO 2
43 1800 X = 158:Y = 30 + 25 * I
8C 1810 FOR J = 1 TO L(I)
6A 1820 DRAW 8 + D(I,J) AT X,Y
EC 1830 X = X - 18
8D 1840 NEXT J,I
DD 1850 DRAW 20 AT X,Y
C7 1860 DRAW 21 AT 158,96
FD 1870 RETURN
18 1880 REM GUESS
3F 1890 VTAB 21: HTAB 8: PRINT "PLEASE ENTER YOUR AN
      SWER"
FF 1900 VTAB 23: HTAB 11: PRINT "THEN HIT ";: INVERS
      E : PRINT "<RETURN>": NORMAL
```

STOP, LOOK, AND LEARN

```
7F 1910 X = 158:Y = 112
E9 1920 G$ = ""
DB 1930 DRAW 22 AT X,Y
50 1940 : REM ENTER DIGIT
53 1950 GOSUB 2000
47 1960 HCOLOR= 0: DRAW 22 AT X,Y
DB 1970 IF A = 21 THEN GOSUB 2060: GOTO 1930: REM MOVE RIGHT
95 1980 IF A < > 13 THEN DIGIT = A - 48: HCOLOR= 3:
    DRAW 8 + DIGIT AT X,Y:X = X - 18:G$ = STR$ (
    DIGIT) + G$: GOTO 1930
00 1990 RETURN
BE 2000 REM ENTER
C0 2010 P = PEEK ( - 16384): IF P < 128 THEN 2010
D0 2020 POKE - 16384,0
41 2030 A = P - 128
F3 2040 IF NOT (A = 13 OR (A = 21 AND G$ < > "") OR
    (A > 47 AND A < 58)) THEN CLICK = PEEK (Z):
    GOTO 2010
E6 2050 RETURN
12 2060 REM MOVE RIGHT
DE 2070 S$ = LEFT$ (G$,1):G$ = MID$ (G$,2):V = ASC (
    S$) - 48
4E 2080 X = X + 18: DRAW 8 + V AT X,Y: HCOLOR= 3
7A 2090 CLICK = PEEK (Z)
D4 2100 RETURN
93 2110 REM WRONG
EB 2120 FOR I = 1 TO 150:CLICK = PEEK (Z): NEXT I
D9 2130 VTAB 21: HTAB 1: INVERSE : PRINT "SORRY:";:
    NORMAL : PRINT " THE ANSWER IS ";AW;". "
E4 2140 RETURN
50 2150 REM RIGHT
19 2160 VTAB 21: HTAB 15: INVERSE : PRINT "VERY GOOD
    !";: NORMAL
94 2170 GOSUB 2280
E6 2180 X = 220:Y = 80
F0 2190 S(1) = 2 * C - 1:S(2) = S(1) + 1
17 2200 FOR JUMPS = 1 TO 3
03 2210 FOR J = 1 TO 2
FB 2220 HCOLOR= K1: DRAW S(J) AT X,Y
BA 2230 FOR PAUSE = 1 TO 125: NEXT PAUSE
37 2240 IF NOT (JUMPS = 3 AND J = 2) THEN HCOLOR= 0:
    DRAW S(J) AT X,Y
A4 2250 NEXT J,JUMPS
CF 2260 CNT = CNT + 1
F2 2270 RETURN
83 2280 REM MUSIC
93 2290 NGP = NGP + 1: IF NGP = 6 THEN NGP = 1
ED 2300 F = NTE(NGP - 1) + 1:L = NTE(NGP)
50 2310 FOR I = F TO L
```


STOP, LOOK, AND LEARN

```
67 2320 POKE 794, LN(I): POKE 795, PT(I): CALL 768
7E 2330 NEXT I
EB 2340 RETURN
27 2350 REM PERFECT SCORE
91 2360 CALL - 3086
CB 2370 DUCK = 5: YD(5) = 108: YD(6) = 101
1A 2380 VTAB 21: HTAB 10: PRINT "YOU GOT ALL "; K: " R
    IGH T !"
3C 2390 VTAB 23: HTAB 14: PRINT SPC( 13);
AF 2400 : REM FLIGHT
BB 2410 FOR X = 70 TO 265 STEP 3
66 2420 HCOLOR= K2: DRAW DUCK AT X, 100: HCOLOR= 3: D
    RAW 7 AT X - 54, YD(DUCK)
AA 2430 FOR PAUSE = 1 TO 120: NEXT PAUSE
7F 2440 HCOLOR= 0: DRAW DUCK AT X, 100: DRAW 7 AT X -
    54, YD(DUCK)
89 2450 DUCK = 11 - DUCK
9B 2460 NEXT X
F6 2470 RETURN
```

FUN WITH FRACTIONS

Fractions are always tougher than they look. How can two fractions like $1/4$ and $5/9$ possibly be added together? With a little practice and patience, students will quickly find that this problem is much easier than it looks.

"Fun with Fractions" has two levels of difficulty. The easy method makes the bottom number (denominator) in both fractions the same value. To solve the problem only the two top numbers (the numerators) would be added together. If the problem was, for example, $1/4 + 2/4 = ?$, the answer would be $3/4$. Again, only the two top numbers have to be added together. The denominator stays the same.

The more difficult level has different values for the two denominators. Since these numbers are not the same, they cannot be added together without some adjustment. For instance, suppose the problem was $1/3 + 1/2 = ?$. To solve this, we will have to find a relationship between the two values, a *common denominator*.

The best approach is to multiply each fraction by 1, but with a little twist. First, multiply $1/3$ by $2/2$, which is the same as multiplying by 1, since 2 divided by 2 equals 1. The new fraction is $2/6$. Now, multiply $1/2$ by $3/3$, and the result is $3/6$. The original equation of $1/3 + 1/2 = ?$ becomes $2/6 + 3/6 = ?$, which easily yields the desired result of $5/6$. The key to solving an equation with different denominators is to multiply each fraction by 1—using the denominator of the other fraction divided by itself.

This program draws objects on the screen using shapes from a binary file. This file is created by a shape file generator (Program 4-1), which you should enter and run first and only once. A shape file will be created on your disk for this program to read. Then, whenever you want to use this program, just run Program 4-5. You don't have to run Program 4-1 again.

Program 4-5. Fun with Fractions

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
10 100 LOMEM: 18500
E2 110 REM FUN WITH FRACTIONS
A8 120 REM INITIALIZE
```

STOP, LOOK, AND LEARN

```
47 130 GOSUB 240
9A 140 REM PLAY
4F 150 GOSUB 830
EC 160 REM PLAY AGAIN
62 170 TEXT : HOME
0F 180 VTAB 12: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
64 190 GET S$
D3 200 IF S$ = "Y" OR S$ = "y" THEN 150
01 210 IF S$ < > "N" AND S$ < > "n" THEN 180
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
AD 240 REM INITIALIZE
4F 250 : REM TITLE
4F 260 GOSUB 340
9D 270 : REM VALUES
5D 280 GOSUB 390
AC 290 : REM TYPE MONITOR
51 300 GOSUB 690
ED 310 : REM SHAPES
52 320 GOSUB 770
19 330 RETURN
2C 340 REM TITLE
2F 350 PRINT CHR$(21): TEXT : HOME
89 360 VTAB 12: HTAB 11: PRINT "FUN WITH FRACTIONS"
83 370 FOR PAUSE = 1 TO 1500: NEXT
23 380 RETURN
5B 390 REM VALUES
87 400 BELL$ = CHR$(7):Z = - 16336: REM CLICK
3C 410 DIM LN(113),PT(113)
12 420 K = 5: REM PROBLEMS IN A SET
75 430 : REM MUSIC MAKER
17 440 DATA 172,27,3,174,27,3,232,208,253,169,4,32,1
    68,252,173,48,192,136,208,239,206,26,3,208,23
    1,96
AC 450 FOR I = 768 TO 793
D2 460 READ V: POKE I,V
0A 470 NEXT
4B 480 : REM DIXIE
D9 490 DATA 1,151,1,125,2,85,2,85,1,85,1,105,1,125,1
    ,134,2,151,2,151
89 500 DATA 2,151,2,125,2,166,2,166,2,166,2,151,2,16
    6,2,151,1,166,1,177
02 510 DATA 1,182,1,192,6,202,1,182,1,151,6,182,1,15
    1,1,125,6,151,1,105
38 520 DATA 1,125,4,85,1,151,1,151,2,182,2,202,2,192
    ,2,182,2,166,4,182
50 530 DATA 2,166,6,192,2,166,6,192,2,151,2,182,2,20
    2,2,192,2,182,2,166
```

STOP, LOOK, AND LEARN

```
40 540 DATA 2,177,2,182,2,166,2,151,2,125,2,182,2,12
5,2,125,4,105,2,125
54 550 DATA 6,85,2,125,6,105,2,166,2,151,2,125,2,182
,2,202,2,192,4,182
08 560 DATA 2,125,6,85,2,125,6,105,2,166,2,151,2,125
,2,202,2,182,2,192
18 570 DATA 4,182
2C 580 FOR I = 1 TO 32
CE 590 READ LN(I),PT(I)
AD 600 LN(I + 32) = LN(I):PT(I + 32) = PT(I)
FF 610 NEXT
EF 620 FOR I = 65 TO 113
C3 630 READ LN(I),PT(I)
06 640 NEXT
23 650 : REM NOTE GROUPS
E0 660 DATA 32,64,91,102,113
3C 670 FOR I = 1 TO 5: READ NTE(I): NEXT
26 680 RETURN
56 690 REM MONITOR
4A 700 HOME
5F 710 VTAB 12: HTAB 1: PRINT "ARE YOU USING A COLOR
MONITOR (Y/N) ? ";BELL$;
5C 720 GET S$
C3 730 IF S$ < > "Y" AND S$ < > "y" AND S$ < > "N" A
ND S$ < > "n" THEN 710
25 740 K1 = 3:K2 = 3
14 750 IF S$ = "Y" OR S$ = "y" THEN K1 = 6:K2 = 5
23 760 RETURN
09 770 REM SHAPES
5A 780 HOME
AA 790 VTAB 12: HTAB 16: PRINT "READING"
0E 800 PRINT CHR$(4);"BLOAD LEARN.SHAPE"
95 810 POKE 233,64: POKE 232,0
1C 820 RETURN
9F 830 REM PLAY
A5 840 : REM DIFFICULTY
E2 850 GOSUB 1050
46 860 CNT = 0:NGP = 0
C4 870 FOR Q = 1 TO K
BB 880 : REM GET VALUES
F4 890 GOSUB 1170
25 900 : REM DRAW
EF 910 GOSUB 1290
44 920 : REM GUESS
7F 930 IF PICK = 2 THEN GOSUB 1470
F7 940 GOSUB 1770
5F 950 : REM CLEAR LINES
F7 960 GOSUB 1950
39 970 : REM RESPOND
```

STOP, LOOK, AND LEARN

```
20 980 ON ( ABS (AW - GUESS) < .0001) + 1 GOSUB 2100
    ,2140
73 990 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
54 1000 GET S$
77 1010 NEXT Q
5A 1020 : REM DISPLAY DUCK
84 1030 IF CNT = K THEN GOSUB 2350
E1 1040 RETURN
5A 1050 REM DIFFICULTY
50 1060 HOME
03 1070 PRINT "YOU'LL NEED TO FIND A COMMON DENOMINA
    TOR";
3C 1080 PRINT "FOR YOUR FRACTIONS IN THE ";: INVERSE
    : PRINT "HARD";: NORMAL : PRINT " GAME.": P
    RINT
90 1090 PRINT "IN THE ";: INVERSE : PRINT "EASY";: N
    ORMAL : PRINT " YOU WON'T."
50 1100 VTAB 9: HTAB 15: PRINT "VERSION:"
86 1110 VTAB 11: HTAB 16: INVERSE : PRINT "1";: NORM
    AL : PRINT " EASY"
3C 1120 VTAB 13: HTAB 16: INVERSE : PRINT "2";: NORM
    AL : PRINT " HARD"
F7 1130 VTAB 16: HTAB 16: PRINT "==> ? ";:CLICK = PE
    EK (Z)
66 1140 GET S$
13 1150 PICK = VAL (S$): IF PICK < 1 OR PICK > 2 THE
    N 1130
E8 1160 RETURN
5C 1170 REM VALUES
9B 1180 FOR I = 1 TO 2
85 1190 N(I) = INT ( RND (1) * 8) + 1
C2 1200 D(I) = INT ( RND (1) * 8) + 1
73 1210 NEXT I
B6 1220 IF PICK = 2 AND D(1) = D(2) THEN 1180
68 1230 IF PICK = 1 THEN D(2) = D(1)
F1 1240 : REM ANSWER
76 1250 IF PICK = 1 THEN AW(1) = N(1) + N(2):AW(2) =
    D(1)
48 1260 IF PICK = 2 THEN AW(1) = N(1) * D(2) + N(2)
    * D(1):AW(2) = D(1) * D(2)
A3 1270 AW = AW(1) / AW(2)
F5 1280 RETURN
F4 1290 REM DRAW
F8 1300 HOME : HGR : ROT= 0: SCALE= 1
89 1310 : REM BOX
02 1320 HCOLOR= 3
FC 1330 HPOINT 5,5 TO 274,5: HPOINT TO 274,149: HPOINT
    TO 5,149: HPOINT TO 5,5
32 1340 HPOINT 6,6 TO 273,6: HPOINT TO 273,148: HPOINT
    TO 6,148: HPOINT TO 6,6
```

STOP, LOOK, AND LEARN

```
98 1350 : REM PROBLEM
97 1360 FOR I = 1 TO 2
3F 1370 X = 90 * I - 60
80 1380 DRAW N(I) + 8 AT X,65
02 1390 DRAW 19 AT X - 3,80: DRAW 19 AT X + 3,80
64 1400 DRAW D(I) + 8 AT X,95
77 1410 NEXT I
3C 1420 X1 = 75:X2 = 169: IF PICK = 2 THEN X1 = 90:X
    2 = 180
3F 1430 DRAW 18 AT X1,80
1D 1440 DRAW 19 AT X2,75: DRAW 19 AT X2,85
BC 1450 DRAW 21 AT 250,80
F1 1460 RETURN
DB 1470 REM ENTER RATIOS
AF 1480 VTAB 21: HTAB 3: PRINT "PLEASE ENTER A RATIO
    TO MULTIPLY BY"
A5 1490 FOR I = 1 TO 2
50 1500 : REM DRAW BOX
99 1510 GOSUB 1690
4A 1520 VTAB 23: HTAB 17: INVERSE : PRINT "RATIO:":;
    NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
6A 1530 GET S$
B4 1540 R = VAL (S$): IF R < 1 THEN 1520
66 1550 R(I) = R
43 1560 : REM DRAW NUMBERS
AC 1570 DRAW 8 + R AT X,65: DRAW 8 + R AT X,95
95 1580 NEXT I
83 1590 GOSUB 1950: REM CLEAR LINES
6A 1600 : REM CHECK ENTRY
54 1610 IF D(1) * R(1) < > D(2) * R(2) THEN GOSUB 16
    30: GOTO 1480
E5 1620 RETURN
FD 1630 REM NO COMMON DENOMINATOR
7B 1640 VTAB 21: HTAB 2: INVERSE : PRINT "WARNING:":;
    : NORMAL : PRINT " NO COMMON DENOMINATOR !"
02 1650 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
7B 1660 GET S$
7D 1670 GOSUB 1950: REM CLEAR LINES
FD 1680 RETURN
C7 1690 REM BOX
13 1700 X = 90 * I - 30
A5 1710 FOR Y = 53 TO 107 STEP 3
DB 1720 HCOLOR= 3: DRAW 19 AT X - 3,Y: DRAW 19 AT X
    + 3,Y
95 1730 NEXT Y
16 1740 HPLLOT X - 16,79: HPLLOT X - 14,79: HPLLOT X -
    16,81: HPLLOT X - 14,81: HPLLOT X - 15,80: REM
    DOT
79 1750 HCOLOR= 0: DRAW 19 AT X,80
F7 1760 RETURN
```


STOP, LOOK, AND LEARN

```
2A 1770 REM ENTER ANSWER
6A 1780 F$(1) = "NUMERATOR":F$(2) = "DENOMINATOR"
AB 1790 FOR I = 1 TO 2
77 1800 S$ = "PLEASE ENTER YOUR " + F$(I)
D1 1810 VTAB 21: HTAB 21 - LEN (S$) / 2: PRINT S$
07 1820 VTAB 23: HTAB 12: PRINT "THEN HIT ";: INVERS
   E : PRINT "<RETURN>": NORMAL
9C 1830 X = 214:Y = 30 * I + 35
EF 1840 G$ = ""
59 1850 HCOLOR= 3: DRAW 22 AT X,Y
56 1860 : REM ENTER DIGIT
AF 1870 GOSUB 1990: IF X = 268 AND A < > 13 AND A <
   > 8 THEN PRINT BELL$;: GOTO 1870
4D 1880 HCOLOR= 0: DRAW 22 AT X,Y
E7 1890 IF A = 8 THEN GOSUB 2050: GOTO 1850: REM MOV
   E LEFT
77 1900 IF A < > 13 THEN DIGIT = A - 48: HCOLOR= 3:
   DRAW 8 + DIGIT AT X,Y:X = X + 18:G$ = G$ + S
   TR$ (DIGIT): GOTO 1850
A4 1910 G(I) = VAL (G$)
85 1920 NEXT I
8B 1930 GUESS = 0: IF G(2) < > 0 THEN GUESS = G(1) /
   G(2)
F3 1940 RETURN
23 1950 REM CLEAR LINES
DC 1960 VTAB 21: HTAB 1: PRINT SPC( 39)
E4 1970 VTAB 23: HTAB 1: PRINT SPC( 39)
04 1980 RETURN
F3 1990 REM ENTER
8B 2000 P = PEEK ( - 16384): IF P < 128 THEN 2000
CC 2010 POKE - 16384,0
3D 2020 A = P - 128
78 2030 IF NOT (A = 13 OR (A = 8 AND G$ < > "")) OR (
   A > 47 AND A < 58)) THEN CLICK = PEEK (Z): G
   OTO 2000
E2 2040 RETURN
16 2050 REM MOVE LEFT
DF 2060 S$ = RIGHT$(G$,1):G$ = MID$(G$,1, LEN (G$)
   - 1):V = ASC (S$) - 48
4B 2070 X = X - 18: DRAW 8 + V AT X,Y: HCOLOR= 3
75 2080 CLICK = PEEK (Z)
F6 2090 RETURN
8F 2100 REM WRONG
E7 2110 FOR I = 1 TO 150:CLICK = PEEK (Z): NEXT I
A2 2120 VTAB 21: HTAB 2: INVERSE : PRINT "SORRY:";:
   NORMAL : PRINT " THE ANSWER IS ";AW(1);"/";A
   W(2);". "
E0 2130 RETURN
54 2140 REM RIGHT
```

STOP, LOOK, AND LEARN

```
15 2150 VTAB 21: HTAB 15: INVERSE : PRINT "VERY GOOD
!";: NORMAL
90 2160 GOSUB 2280
64 2170 X = 140:Y = 29
F8 2180 S(1) = INT ( RND (1) * 3) + 1: IF S(1) = 2 T
HEN 2180
68 2190 S(2) = S(1) + 1
17 2200 FOR JUMPS = 1 TO 3
03 2210 FOR J = 1 TO 2
0C 2220 HCOLOR= K2: DRAW S(J) AT X,Y
BA 2230 FOR PAUSE = 1 TO 125: NEXT PAUSE
37 2240 IF NOT (JUMPS = 3 AND J = 2) THEN HCOLOR= 0:
DRAW S(J) AT X,Y
A4 2250 NEXT J,JUMPS
CF 2260 CNT = CNT + 1
F2 2270 RETURN
83 2280 REM MUSIC
93 2290 NGP = NGP + 1: IF NGP = 6 THEN NGP = 1
ED 2300 F = NTE(NGP - 1) + 1:L = NTE(NGP)
50 2310 FOR I = F TO L
67 2320 POKE 794,LN(I): POKE 795,PT(I): CALL 768
7E 2330 NEXT I
EB 2340 RETURN
27 2350 REM PERFECT SCORE
91 2360 CALL - 3086
CB 2370 DUCK = 5:YD(5) = 108:YD(6) = 101
1A 2380 VTAB 21: HTAB 10: PRINT "YOU GOT ALL ";K;" R
IGHT !"
3C 2390 VTAB 23: HTAB 14: PRINT SPC( 13);
AF 2400 : REM FLIGHT
B8 2410 FOR X = 70 TO 265 STEP 3
66 2420 HCOLOR= K2: DRAW DUCK AT X,100: HCOLOR= 3: D
RAW 7 AT X - 54,YD(DUCK)
AA 2430 FOR PAUSE = 1 TO 120: NEXT PAUSE
7F 2440 HCOLOR= 0: DRAW DUCK AT X,100: DRAW 7 AT X -
54,YD(DUCK)
89 2450 DUCK = 11 - DUCK
9B 2460 NEXT X
F6 2470 RETURN
```

TIME TO TELL

This program teaches children to tell time. The Apple draws a clock face, and the child types in the time that corresponds to the position the clock hands point to. There are three levels of difficulty: asking for the time by hour, by quarter hour, or down to the closest five-minute interval.

With repeated drills, kids will soon be able to tell time on their own—without looking at a digital watch. If the minute hand is on 3, for example, and the hour hand on 1, the child would type 1:15 (the Apple provides the colon).

When the program draws the clock face on some monitors, it might appear more oval than round. To remedy this, type in and run this program:

```
10 HOME: HGR: HCOLOR=3
20 HPlot 0,0 TO 150,0
30 HPlot 0,0 TO 0,150
40 GET S$: TEXT
```

The Apple will draw two lines on your screen. Measure them and divide the length of the vertical line by the length of the horizontal line. You should get a number like 8/7 in fractional form. This is your screen's aspect ratio. Insert this number into line 510 of Program 4-6B instead of the 1.

The Apple draws the clock on the screen using shapes from a binary file. This file is created by Program 4-6A, which you should enter and run first and only once. A shape file will be created on your disk for the main program to read. Then, whenever you want to use this program, just run Program 4-6B. You don't have to run Program 4-6A again.

Program 4-6A. Time to Tell Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
2C 100 REM SHAPES FOR 'TIME'
7C 110 REM DIRECTORY
BB 120 DATA 26,0,54,0,63,0,75,0,88,0,99,0,112,0,125,
    0,136,0,150,0
0E 130 DATA 162,0,181,0,197,0,219,0,28,1,66,1,154,1,
    225,1,41,2,146,2
DA 140 DATA 246,2,83,3,207,3,40,4,139,4,219,4,24,5
69 150 REM NUMBERS
```

STOP, LOOK, AND LEARN

```

52 160 DATA 36,60,42,54,54,46,63,7,0
24 170 DATA 45,32,28,63,23,22,17,23,46,45,37,0
BD 180 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
14 190 DATA 33,36,23,23,23,46,45,61,54,6,0
78 200 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
BE 210 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
47 220 DATA 30,54,36,5,40,40,32,63,63,7,0
EE 230 DATA 45,50,30,63,7,32,12,28,36,41,45,50,6,0
12 240 DATA 39,35,12,45,21,54,47,54,51,59,63,0
C0 250 DATA 36,12,45,21,54,54,30,63,28,52,30,59,47,3
    6,36,36,62,7,0
D0 260 DATA 9,54,46,63,31,63,37,36,36,47,44,9,49,47,
    54,0
05 270 DATA 8,24,12,45,21,54,59,30,30,46,45,61,63,63
    ,59,47,36,36,36,62,7,0
0A 280 REM ELLIPSE
6A 290 DATA 36,36,44,54,54,54,54,46,36,36,36,36,44,5
    4,54,54,54,46,36,36
DE 300 DATA 36,36,21,46,62,46,62,46,30,30,55,63,63,4
    4,60,44,60,36,36,36
BD 310 DATA 55,54,54,54,54,62,36,36,36,36,36,23,54,5
    4,54,54,7,32,36,36
47 320 DATA 60,50,54,54,0
1C 330 REM CIRCLE
85 340 DATA 36,36,45,46,46,54,54,39,36,39,60,54,46,5
    4,46,30,39,36,55,54
A3 350 DATA 39,36,36,36,60,54,54,54,54,60,36,36,36,2
    3,54,54,6,0
8D 360 REM MIN. HAND #1
48 370 DATA 36,36,37,36,36,36,36,36,36,36,36,36,3
    6,36,36,36,36,36,36
2E 380 DATA 36,36,36,36,36,36,36,60,54,54,54,54,5
    4,54,54,54,54,54,54
32 390 DATA 54,54,54,54,54,54,54,54,54,54,54,54,3
    9,36,36,36,36,36,36
FD 400 DATA 36,36,36,36,36,36,36,36,36,36,36,36,3
    6,36,36,36,36,36,47
B7 410 DATA 45,61,60,39,45,39,36,0
07 420 REM MIN. HAND #2
F4 430 DATA 44,36,41,60,47,44,38,37,39,45,60,44,37,3
    9,45,60,44,37,39,45
A8 440 DATA 60,44,37,39,45,60,44,37,39,45,60,44,37,3
    9,45,60,44,37,39,45
AA 450 DATA 60,44,37,39,45,60,44,37,39,45,60,44,37,3
    9,45,60,44,37,39,45
A5 460 DATA 37,63,39,47,44,46,37,39,37,4,0
91 470 REM MIN. HAND #3
95 480 DATA 44,45,36,53,38,37,53,36,53,37,44,46,36,5
    3,37,44,46,36,53,37

```

STOP, LOOK, AND LEARN

58 490 DATA 44,46,36,53,37,44,46,36,53,37,44,46,36,5
3,37,44,46,36,53,37
47 500 DATA 44,46,36,53,37,44,46,36,53,37,44,46,36,5
3,37,44,46,36,53,37
4F 510 DATA 36,53,54,53,36,36,53,54,44,32,45,0
98 520 REM HOUR HAND #1
BE 530 DATA 36,36,45,36,36,36,36,36,36,36,36,36,36,3
6,36,36,36,60,54
1E 540 DATA 54,54,54,54,54,54,54,54,54,54,54,54,54,5
4,62,36,36,36,36,36
E2 550 DATA 36,36,36,36,36,36,36,36,36,36,60,54,54,5
4,54,54,54,54,54
22 560 DATA 54,54,54,54,54,54,62,36,36,36,36,36,36,3
6,36,36,36,36,36
42 570 DATA 36,36,36,63,45,45,45,45,39,63,63,63,44,4
5,45,61,60,63,47,44
F0 580 DATA 37,63,37,4,0
27 590 REM HOUR HAND #2
09 600 DATA 36,44,60,39,45,53,37,60,63,39,45,45,60,6
3,44,45,37,60,62,60
43 610 DATA 62,36,45,45,60,63,44,45,37,60,62,60,62,3
6,45,45,60,63,44,45
97 620 DATA 37,60,62,60,62,36,45,45,60,63,44,45,37,6
0,62,60,62,36,45,45
B5 630 DATA 60,63,44,45,37,60,62,60,62,36,45,45,44,6
3,63,44,45,37,63,63
97 640 DATA 60,47,44,53,37,53,45,46,60,60,44,63,63,3
9,41,45,60,47,36,0
A0 650 REM HOUR HAND #3
1D 660 DATA 44,36,45,44,63,63,38,37,44,46,44,38,37,6
3,39,45,45,60,63,44
17 670 DATA 45,37,63,39,45,45,60,63,44,45,37,63,39,4
5,45,60,63,44,45,37
C4 680 DATA 63,39,45,45,60,63,44,45,37,63,39,45,45,6
0,63,44,45,37,63,39
BA 690 DATA 45,45,60,63,44,45,37,63,39,45,45,46,36,6
3,63,39,47,45,45,37
8F 700 DATA 63,63,47,44,45,37,63,47,44,37,47,36,0
1A 710 REM HOUR HAND #4
59 720 DATA 44,12,45,38,39,39,47,44,46,46,38,37,39,3
9,47,44,46,46,38,37
4E 730 DATA 39,39,47,44,46,46,38,37,39,39,47,44,46,4
6,38,37,39,47,44
2A 740 DATA 46,46,38,37,39,39,47,44,46,46,38,37,39,3
9,47,44,46,46,38,37
52 750 DATA 39,39,47,44,46,46,38,37,39,39,47,44,46,4
6,38,37,39,39,47,44
2E 760 DATA 46,46,38,37,39,39,47,44,46,46,38,37,39,3
9,47,44,46,46,38,37

STOP, LOOK, AND LEARN

A0 770 DATA 39,39,47,36,39,47,45,54,46,46,46,46,38,3
 6,39,39,39,44,46,46
 3F 780 DATA 38,36,63,0
 AA 790 REM HOUR HAND #5
 36 800 DATA 37,45,36,52,54,53,36,36,53,54,37,36,44,5
 4,46,36,36,53,54,37
 F7 810 DATA 36,44,54,46,36,36,53,54,37,36,44,54,46,3
 6,36,53,54,37,36,44
 CF 820 DATA 54,46,36,36,53,54,37,36,44,54,46,36,36,5
 3,54,37,36,44,54,46
 1A 830 DATA 36,36,53,54,37,36,60,44,53,54,54,53,44,6
 0,36,36,53,54,53,44
 02 840 DATA 60,36,53,53,36,53,44,5,0
 24 850 REM HOUR HAND #6
 0E 860 DATA 45,37,37,44,53,55,53,63,46,37,37,36,53,5
 4,37,36,44,53,55,53
 DD 870 DATA 55,37,37,36,53,54,37,36,44,53,55,53,55,3
 7,37,36,53,54,37,36
 23 880 DATA 44,53,55,53,55,37,37,36,53,54,37,36,44,5
 3,55,53,55,37,37,36
 04 890 DATA 53,54,37,36,44,53,55,53,55,37,37,36,53,5
 4,37,36,44,53,55,53
 87 900 DATA 55,53,38,37,36,36,60,39,46,53,53,54,38,3
 7,36,53,38,45,0
 CA 910 REM DUCK 1
 31 920 DATA 39,60,44,44,50,46,62,62,46,54,45,46,45,4
 4,37,45,21,46,46,61
 B2 930 DATA 39,63,62,60,63,62,55,39,23,23,39,44,39,3
 9,60,36,60,36,61,36
 A7 940 DATA 39,60,60,52,54,53,47,46,54,54,53,54,53,4
 6,54,39,55,39,60,62
 3C 950 DATA 36,61,55,62,60,39,63,45,45,37,44,45,38,6
 0,39,37,47,36,4,0
 DB 960 REM DUCK 2
 87 970 DATA 7,32,61,60,63,55,63,62,62,60,39,63,45,45
 ,37,45,44,45,45,53
 AB 980 DATA 45,55,46,44,45,44,37,45,21,46,46,61,39,6
 3,62,60,63,62,55,63
 6C 990 DATA 55,55,63,62,63,38,55,63,63,62,44,37,45,4
 4,36,37,45,44,53,5,0
 0C 1000 REM BANNER
 B0 1010 DATA 36,55,54,55,62,36,44,36,60,54,63,36,37,
 63,54,54,53,54,39,36
 96 1020 DATA 31,36,36,37,63,54,54,22,46,62,39,36,4,3
 2,36,55,39,55,55,45
 BD 1030 DATA 62,46,62,46,62,55,62,45,44,46,45,53,37,
 53,53,37,45,52,53,63
 F5 1040 DATA 46,45,44,54,47,37,44,54,45,60,44,60,44,
 63,63,39,44,46,44,46

STOP, LOOK, AND LEARN

```
62 1050 DATA 36,60,63,36,53,37,53,53,36,53,22,45,4,5
    6,36,53,37,44,54,37
74 1060 DATA 36,45,44,52,62,54,54,31,63,46,53,55,53,
    63,63,55,50,46,36,53
EA 1070 DATA 38,37,44,54,44,44,38,44,38,37,61,39,47,
    37,39,45,45,12,45,12
60 1080 DATA 45,45,53,41,53,41,45,45,37,41,12,45,0
0D 1090 FOR I = 16384 TO 17840
EC 1100 READ V
BC 1110 POKE I,V
AB 1120 NEXT
8C 1130 PRINT CHR$(4);"BSAVE TIME.SHAPE,A16384,L145
    7"
D4 1140 END
```

Program 4-6B. Time to Tell

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
F2 100 LOMEM: 18000
69 110 REM TIME TO TELL
A8 120 REM INITIALIZE
47 130 GOSUB 240
9A 140 REM PLAY
5A 150 GOSUB 980
EC 160 REM PLAY AGAIN
62 170 TEXT : HOME
0F 180 VTAB 12: HTAB 12: PRINT "PLAY AGAIN (Y/N) ? "
    ;BELL$;
64 190 GET S$
D3 200 IF S$ = "Y" OR S$ = "y" THEN 150
01 210 IF S$ < > "N" AND S$ < > "n" THEN 180
A5 220 HOME : PRINT "BYE-BYE"
90 230 END
AD 240 REM INITIALIZE
4F 250 : REM TITLE
57 260 GOSUB 380
55 270 : REM BASIC VALUES
50 280 GOSUB 420
0C 290 : REM DATA FOR CIRCLE
3E 300 GOSUB 500
B2 310 : REM MUSIC
50 320 GOSUB 570
38 330 : REM SHAPE & ROTATION VALUES
49 340 GOSUB 800
FA 350 : REM READ SHAPE DATA
52 360 GOSUB 920
21 370 RETURN
```

STOP, LOOK, AND LEARN

```
34 380 REM TITLE
37 390 PRINT CHR$(21): TEXT : HOME
01 400 VTAB 12: HTAB 14: PRINT "TIME TO TELL"
16 410 RETURN
4E 420 REM VALUES
1F 430 DIM MIN(11,2), HOUR(23,2), LN(94), PT(94)
8F 440 BELL$ = CHR$(7):Z = - 16336: REM CLICK
18 450 K = 5: REM PROBLEMS IN A SET
A5 460 : REM DIFFICULTY
4F 470 DATA "EASY : TELL THE HOUR","MEDIUM: TELL TH
E QUARTER HOUR","HARD : TELL ANY TIME"
80 480 READ M$(1),M$(2),M$(3)
26 490 RETURN
80 500 REM DATA FOR CIRCLE
A5 510 AR = 1: REM ASPECT RATIO
B9 520 TPI = 2 * 3.14159
62 530 X0 = 140:Y0 = 80
8E 540 DEF FN X(V) = INT (X0 + AR * RADIUS * COS (V)
+ .5)
2E 550 DEF FN Y(V) = INT (Y0 + RADIUS * SIN (V) + .5
)
21 560 RETURN
69 570 REM MUSIC
20 580 DATA 172,27,3,174,27,3,232,208,253,169,4,32,1
68,252,173,48,192,136,208,239,206,26,3,208,23
1,96
B5 590 FOR I = 768 TO 793
C8 600 READ V: POKE I,V
FF 610 NEXT
35 620 : REM ODE TO JOY
AA 630 DATA 8,166,4,172,4,182,4,182,4,172,4,166,4,15
1,4,134,4,134,4,151
80 640 DATA 4,166,6,166,2,151,8,151,4,166,4,166,4,17
2,4,182,4,182,4,172
D6 650 DATA 4,166,4,151,4,134,4,134,4,151,4,166,6,15
1,2,134,8,134,8,151
68 660 DATA 4,166,4,134,4,151,2,166,2,172,4,166,4,13
4,4,151,2,166,2,172
88 670 DATA 4,166,4,134,4,134,4,151,8,85,4,166,4,166
,4,172,4,182,4,182
17 680 DATA 4,172,4,166,2,172,2,151,4,134,4,134,4,15
1,4,166,6,151,2,134
79 690 DATA 8,134,4,151,4,151,4,166,4,134,4,151,2,16
6,2,172,4,166,4,134
50 700 DATA 4,151,2,166,2,172,4,166,4,151,4,134,4,15
1,8,85,4,166,4,166
3F 710 DATA 4,172,4,182,4,182,4,172,4,166,2,172,2,15
1,4,134,4,134,4,151
A7 720 DATA 4,166,6,151,2,134,8,134
74 730 FOR I = 1 TO 94
```

STOP, LOOK, AND LEARN

```
C6 740 READ LN(I),PT(I)
09 750 NEXT
88 760 : REM GROUPS
C1 770 DATA 14,29,45,61,94
3F 780 FOR I = 1 TO 5: READ NTE(I): NEXT
29 790 RETURN
1F 800 REM SHAPE & ROTATION VALUES
EE 810 C = 0
2C 820 FOR I = 0 TO 48 STEP 16
03 830 FOR J = 15 TO 17
68 840 MIN(C,1) = J:MIN(C,2) = I:C = C + 1
AF 850 NEXT J,I
F8 860 C = 0
36 870 FOR I = 0 TO 48 STEP 16
A2 880 FOR J = 18 TO 23
41 890 HOUR(C,1) = J:HOUR(C,2) = I:C = C + 1
A6 900 NEXT J,I
1B 910 RETURN
01 920 REM SHAPES
52 930 HOME
A2 940 VTAB 12: HTAB 16: PRINT "READING"
FB 950 PRINT CHR$(4);"BLOOD TIME.SHAPE"
A0 960 POKE 233,64: POKE 232,0
27 970 RETURN
AA 980 REM PLAY
B0 990 : REM DIFFICULTY
48 1000 GOSUB 1230
65 1010 : REM DRAW CLOCK
57 1020 GOSUB 1330
8C 1030 : REM INITIAL VALUES
57 1040 GOSUB 1510
2A 1050 CNT = 0:NGP = 0
27 1060 FOR Q = 1 TO K
15 1070 : REM GET VALUES
93 1080 GOSUB 1660
72 1090 : REM ROTATE HANDS
79 1100 GOSUB 1760
26 1110 : REM GUESS
59 1120 GOSUB 1900
04 1130 : REM RESPOND
99 1140 VTAB 24: HTAB 10: PRINT SPC(21):
33 1150 ON (GUESS = AW) + 1 GOSUB 2170,2220
9F 1160 : REM RESET OLD VALUES
58 1170 HR(1) = HR(2):MN(1) = MN(2)
86 1180 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
7A 1190 GET S$
77 1200 NEXT Q
BF 1210 IF CNT = K THEN GOSUB 2320
DD 1220 RETURN
56 1230 REM DIFFICULTY
```

STOP, LOOK, AND LEARN

```
4C 1240 HOME
CB 1250 VTAB 7: HTAB 15: INVERSE : PRINT "DIFFICULTY
"
AS 1260 FOR I = 1 TO 3
2A 1270 VTAB I * 2 + 9: HTAB 7: INVERSE : PRINT I;:
NORMAL : PRINT CHR$ (32);M$(I)
C5 1280 NEXT
14 1290 VTAB 18: HTAB 9: PRINT "=> ? ";:CLICK = PEE
K (Z)
5A 1300 GET S$
4B 1310 PICK = VAL (S$): IF PICK < 1 OR PICK > 3 THE
N 1290
DF 1320 RETURN
DE 1330 REM DRAW
9B 1340 HOME : HGR : ROT= 0: SCALE= 1:RADIUS = 79
DE 1350 HCOLOR= 3
3B 1360 DT = .01
49 1370 FOR I = 0 TO TPI STEP DT
3E 1380 HPLOT X0,Y0 TO FN X(I), FN Y(I)
CB 1390 NEXT
35 1400 : REM NUMBERS
6A 1410 N = 3:RADIUS = 69
2B 1420 FOR I = 0 TO TPI STEP TPI / 12
10 1430 X = INT (X0 + RADIUS * COS (I) + .5):Y = FN
Y(I)
37 1440 HCOLOR= 0: DRAW 13 AT X,Y
77 1450 HCOLOR= 3: DRAW N AT X,Y
1E 1460 N = N + 1: IF N = 13 THEN N = 1
C5 1470 NEXT
C9 1480 : REM CENTER
8B 1490 HCOLOR= 0: DRAW 14 AT 140,80
DB 1500 RETURN
26 1510 REM INITIAL VALUES
71 1520 MN(1) = 0:ZM = 0: HCOLOR= 0: GOSUB 1550
5F 1530 HR(1) = 0:ZH = 0: GOSUB 1600
EB 1540 RETURN
75 1550 REM DRAW MINUTE
52 1560 SHAPE = MIN(ZM,1): ROT= MIN(ZM,2)
A4 1570 DRAW SHAPE AT X0,Y0
F2 1580 HCOLOR= 0: DRAW 14 AT X0,Y0
FF 1590 RETURN
8B 1600 REM DRAW HOUR
06 1610 IF ZH = 24 THEN ZH = 0
BE 1620 SHAPE = HOUR(ZH,1): ROT= HOUR(ZH,2)
96 1630 DRAW SHAPE AT X0,Y0
E4 1640 HCOLOR= 0: DRAW 14 AT X0,Y0
F1 1650 RETURN
02 1660 REM NEW VALUES
26 1670 VTAB 22: HTAB 4: PRINT SPC( 32)
3F 1680 VTAB 24: HTAB 14: PRINT SPC( 13);
```

STOP, LOOK, AND LEARN

```
76 1690 DFF = INT ( RND (1) * 3 + 1)
C1 1700 HR(2) = HR(1) + DFF: IF HR(2) > 12 THEN HR(2)
    ) = HR(2) - 12
3D 1710 IF PICK = 1 THEN MN(2) = 0
79 1720 IF PICK = 2 THEN MN(2) = 15 * INT ( RND (1)
    * 3 + 1)
87 1730 IF PICK = 3 THEN MN(2) = 5 * INT ( RND (1) *
    11 + 1)
2E 1740 AW = HR(2) * 100 + MN(2)
F3 1750 RETURN
C7 1760 REM ROTATE
CC 1770 FOR H = 0 TO DFF
2C 1780 FOR M = 0 TO 55 STEP 5
CF 1790 IF (H = 0 AND M <= MN(1)) OR (H = DFF AND M
    > MN(2)) THEN 1880
A7 1800 : REM ERASE OLD MINUTE & DRAW NEW
9C 1810 HCOLOR= 3: GOSUB 1550
8C 1820 HCOLOR= 0: GOSUB 1600: REM REDRAW HOUR
C5 1830 ZM = M / 5: HCOLOR= 0: GOSUB 1550
75 1840 CLICK = PEEK (Z)
D4 1850 : REM DRAW NEW HOUR
3C 1860 IF M = 30 OR M = 45 THEN HCOLOR= 3: GOSUB 16
    00: ZH = ZH + 1: HCOLOR= 0: GOSUB 1600: GOSUB
    1550
A9 1870 FOR PAUSE = 1 TO 75: NEXT PAUSE
1C 1880 NEXT M, H
86 1890 RETURN
F9 1900 REM GUESS
26 1910 : REM LABEL
A9 1920 GOSUB 1980
E9 1930 : REM ENTER
87 1940 GOSUB 2070
78 1950 : REM VALUE
1C 1960 GUESS = VAL (G$): IF PICK = 1 THEN GUESS = G
    UESS * 100
FF 1970 RETURN
12 1980 REM LABEL
31 1990 VTAB 24: HTAB 10: PRINT "PLEASE ENTER THE TI
    ME";BELL$;
0F 2000 COL(1) = 18:COL(2) = 19:COL(3) = 21:COL(4) =
    22
74 2010 M$ = CHR$(32) + CHR$(32):L = 4
6F 2020 IF PICK = 1 THEN M$ = "00":L = 2
88 2030 H$ = CHR$(32) + CHR$(32):F = 1
0E 2040 IF HR(2) < 10 THEN H$ = CHR$(32):F = 2
C7 2050 VTAB 22: HTAB 17 + F: INVERSE : PRINT H$ + "
    : " + M$
EA 2060 RETURN
DA 2070 REM ENTER
D8 2080 G$ = CHR$(32):C = F
```

STOP, LOOK, AND LEARN

```
BF 2090 VTAB 22: HTAB COL(C):CLICK = PEEK (Z)
57 2100 GET S$
73 2110 A = ASC (S$): IF NOT (A = 8 AND C > F) AND N
    OT (A > 47 AND A < 58) THEN 2090
80 2120 IF A = 8 THEN G$ = MID$ (G$,1, LEN (G$) - 1)
    :C = C - 1: GOTO 2090
E9 2130 PRINT S$:G$ = G$ + S$:C = C + 1
7A 2140 IF C < = L THEN 2090
59 2150 NORMAL
EC 2160 RETURN
88 2170 REM WRONG TIME
04 2180 FOR I = 1 TO 150:CLICK = PEEK (Z): NEXT I
99 2190 M$ = "0" + STR$ (MN(2)):M$ = RIGHT$ (M$,2)
80 2200 VTAB 22: HTAB 4: INVERSE : PRINT "SORRY:";:
    NORMAL : PRINT " THE TIME IS ";: INVERSE : P
    RINT HR(2);":":M$;: NORMAL
DA 2210 RETURN
28 2220 REM RIGHT TIME
15 2230 VTAB 24: HTAB 15: INVERSE : PRINT "VERY GOOD
    !";: NORMAL
C7 2240 CNT = CNT + 1
26 2250 : REM MUSIC
87 2260 NGP = NGP + 1: IF NGP = 6 THEN NGP = 1
08 2270 F = NTE(NGP - 1) + 1:L = NTE(NGP)
6A 2280 FOR I = F TO L
81 2290 POKE 794,LN(I): POKE 795,PT(I): CALL 768
72 2300 NEXT I
DC 2310 RETURN
18 2320 REM PERFECT SCORE
8C 2330 CALL - 3086: ROT= 0
C2 2340 DUCK = 24:YD(1) = 108:YD(2) = 101
10 2350 VTAB 22: HTAB 10: PRINT "YOU GOT ALL ";K;" R
    IGH T !"
32 2360 VTAB 24: HTAB 14: PRINT SPC( 13);
C9 2370 : REM FLIGHT
D2 2380 FOR X = 70 TO 265 STEP 3
7E 2390 HCOLOR= 3: DRAW DUCK AT X,100: DRAW 26 AT X
    - 54,YD(DUCK - 23)
9E 2400 FOR PAUSE = 1 TO 120: NEXT PAUSE
48 2410 HCOLOR= 0: DRAW DUCK AT X,100: DRAW 26 AT X
    - 54,YD(DUCK - 23)
A3 2420 DUCK = 49 - DUCK
8F 2430 NEXT X
EA 2440 RETURN
```


FOREIGN LANGUAGE FLASH CARDS

Now your computer can teach foreign languages. "Foreign Language Flash Cards" displays a word in either English or the language being practiced, and the student types in its meaning in the other language. For example, if you were studying French and the computer flashed *la maison*, you would type in the English meaning, *the house*.

You must prepare and type in your own lists of words. You can get simple vocabulary words from any elementary language text. When you create lists, enter both the English meaning and the foreign meaning. This program uses the word *Spanish* throughout, but when you type in the program you can change it to the language you're studying.

When you practice a list, you have the option of viewing either the English or the foreign language version of the word or phrase. Either way, the computer will keep track of the number of right and wrong answers, which allows you to grade yourself and measure your progress.

Students will find this program especially helpful. If you have a test soon on a specified list of vocabulary words, type them in along with their English equivalents and let the flash cards drill you until you know your words. Since you can save your old lists, you'll always be able to refresh your memory for the final exam.

Travelers can benefit by practicing common words that will help them in everyday situations abroad. These words can be found in pocket dictionaries and phrase books for travelers. You will enjoy your trip even more if you take the time to learn some of the native tongue instead of assuming that everyone around the world speaks English. If you want to learn, the computer can help you start practicing now.

Program 4-7. Foreign Language Flash Cards

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
70 100 REM FOREIGN LANGUAGE FLASH CARDS
A6 110 REM INITIALIZE
30 120 GOSUB 200
```

STOP, LOOK, AND LEARN

```
AF 130 REM CHOOSE FROM MENU
55 140 GOSUB 680
C3 150 ON PICK GOSUB 830,1950,2920,3150
16 160 IF PICK < > 5 THEN 140
52 170 HOME
1E 180 PRINT "AU REVOIR, ADIOS, BYE-BYE."
9B 190 END
A5 200 REM INITIALIZE
47 210 : REM TITLE
4E 220 GOSUB 280
95 230 : REM VALUES
49 240 GOSUB 330
95 250 : REM FILE NAMES
4D 260 GOSUB 520
20 270 RETURN
33 280 REM TITLE
36 290 PRINT CHR$ (21): TEXT : HOME
11 300 VTAB 12: HTAB 6: PRINT "FOREIGN LANGUAGE FLAS
H CARDS"
F2 310 FOR PAUSE = 1 TO 2000: NEXT
17 320 RETURN
4F 330 REM VALUES
6E 340 : REM MAX WORDS PER FILE, & MAX NUMBER OF FIL
ES
D4 350 MW = 200:MF = 200
B0 360 DIM R(MW),WRD$(MW,2),FILE$(MF)
17 370 : REM TWO LANGUAGES
97 380 DATA ENGLISH, SPANISH
F8 390 FOR I = 1 TO 2
D4 400 READ W$:LG$(I) = LEFT$ (W$,10)
FD 410 NEXT
AA 420 : REM MENU OPTIONS
6A 430 DATA PRACTICE YOUR WORDS, CREATE A NEW WORD L
IST, DELETE AN OLD WORD LIST, VIEW FILE NAMES
, EXIT
1D 440 FOR I = 1 TO 5: READ PICK$(I): NEXT
4C 450 D$ = CHR$ (4):BELL$ = CHR$ (7)
12 460 M$ = "": REM MESSAGE
EB 470 Z = - 16336: REM CLICK
FA 480 : REM DOTTED LINE
6D 490 DLINE$ = ""
7B 500 FOR I = 1 TO 25:DLINE$ = DLINE$ + CHR$ (45):
NEXT
17 510 RETURN
4D 520 REM FILE NAMES
24 530 NFILES = 0
AB 540 ONERR GOTO 650
64 550 HOME : VTAB 12: HTAB 11: PRINT "READING FILE
NAMES"
D6 560 PRINT D$;"OPEN WORDCAT"
```

STOP, LOOK, AND LEARN

```
A1 570 PRINT D$;"READ WORDCAT"
DF 580 INPUT NFILES
68 590 FOR I = 1 TO NFILES
72 600 INPUT FILE$(I)
FF 610 NEXT
BA 620 PRINT D$;"CLOSE"
1E 630 GOTO 660
65 640 : REM DELETE FILE
D3 650 PRINT D$;"CLOSE": PRINT D$;"DELETE WORDCAT"
30 660 POKE 216,0: CALL - 3288
24 670 RETURN
68 680 REM MENU
58 690 HOME
FD 700 PRINT M$
87 710 VTAB 5: HTAB 11: PRINT "WOULD YOU LIKE TO"
07 720 FOR I = 1 TO 5
77 730 VTAB I * 2 + 6: HTAB 12: INVERSE : PRINT I;:
    NORMAL : PRINT CHR$ (32);PICK$(I)
07 740 NEXT
19 750 VTAB 19: HTAB 11: PRINT "CHOICE = ? ";:CLICK
    = PEEK (Z)
64 760 GET S$
66 770 PICK = VAL (S$)
ED 780 IF PICK < 1 OR PICK > 5 THEN 750
46 790 : REM NO FILES
F3 800 IF (PICK = 1 OR PICK = 3 OR PICK = 4) AND NFI
    LES = 0 THEN M$ = "THERE AREN'T ANY LISTS ON
    FILE.": GOTO 690
49 810 M$ = ""
1C 820 RETURN
F2 830 REM PRACTICE SESSION
90 840 : REM ENTER FILE NAME
55 850 HOME
98 860 PRINT "PLEASE ENTER THE NAME OF THE FILE THAT
    "
32 870 PRINT "YOU'D LIKE TO PRACTICE WITH."
D8 880 GOSUB 1010
7A 890 IF DUP$ = "" THEN 1000
04 900 : REM READ WORDS
D5 910 GOSUB 1130
CF 920 : REM SHUFFLE WORDS
D8 930 GOSUB 1230
54 940 : REM ENTER TYPE OF TRANSLATION
D8 950 GOSUB 1410
69 960 : REM PAINT SCREEN
E5 970 GOSUB 1520
18 980 : REM PRACTICE
E5 990 GOSUB 1700
D1 1000 RETURN
54 1010 REM FILE NAME
```

STOP, LOOK, AND LEARN

```
42 1020 VTAB 5: HTAB 1: INPUT "FILE NAME ? ";FILE$
55 1030 IF FILE$ = "" THEN 1020
89 1040 FILE$ = LEFT$ (FILE$,15)
E8 1050 : REM CHECK EXISTENCE
8E 1060 DUP$ = ""
A1 1070 IF NFILES = 0 THEN 1120
7A 1080 FOR I = 1 TO NFILES
16 1090 IF FILE$(I) = FILE$ THEN DUP$ = "YES":ITEM =
    I
6D 1100 NEXT I
89 1110 IF PICK < > 2 AND DUP$ = "" THEN M$ = FILE$
    + " DOESN'T EXIST."
DB 1120 RETURN
66 1130 REM READ FILE
71 1140 HOME : VTAB 12: HTAB 14: PRINT "READING WORD
    S"
AF 1150 PRINT D$;"OPEN" + FILE$
45 1160 PRINT D$;"READ" + FILE$
81 1170 INPUT N
5D 1180 FOR I = 1 TO N
2A 1190 INPUT WRD$(I,1),WRD$(I,2)
A5 1200 NEXT
1B 1210 PRINT D$;"CLOSE"
DD 1220 RETURN
F9 1230 REM SHUFFLE
4C 1240 HOME
33 1250 VTAB 12: HTAB 12: PRINT "SHUFFLING WORDS"
73 1260 : REM RANDOM INTEGERS
8D 1270 FOR I = 1 TO N:R(I) = 0: NEXT
5F 1280 FOR I = 1 TO N
ED 1290 V = 1 + INT (N * RND (1)): IF R(V) < > 0 THE
    N 1290
7F 1300 R(V) = I
AB 1310 NEXT
BF 1320 : REM RANDOM WORDS
4D 1330 FOR I = 1 TO N
BC 1340 V = R(I)
14 1350 FOR J = 1 TO 2
CR 1360 WH$ = WRD$(I,J)
C5 1370 WRD$(I,J) = WRD$(V,J)
8D 1380 WRD$(V,J) = WH$
17 1390 NEXT J,I
D9 1400 RETURN
72 1410 REM TYPE OF TRANSLATION
48 1420 HOME
A7 1430 PRINT "WHICH TYPE OF TRANSLATION WOULD YOU"
DB 1440 PRINT "LIKE TO PRACTICE:"
16 1450 FOR J = 1 TO 2
E0 1460 VTAB 2 + J * 2: HTAB 3: PRINT J;". ": INVER
    SE : PRINT LG$(J);: NORMAL : PRINT " TO ";:
    INVERSE : PRINT LG$(3 - J): NORMAL
```

STOP, LOOK, AND LEARN

```
C5 1470 NEXT
14 1480 VTAB 8: HTAB 3: PRINT "CHOICE = ? ";:CLICK =
    PEEK (Z)
D4 1490 GET S$:TYPE = VAL (S$)
03 1500 IF TYPE < 1 OR TYPE > 2 THEN 1480
DF 1510 RETURN
17 1520 REM PAINT SCREEN
1D 1530 HOME : INVERSE
24 1540 FOR J = 1 TO 3
AF 1550 VTAB J: HTAB 1: PRINT SPC( 40)
C3 1560 NEXT
10 1570 VTAB 23: HTAB 1: PRINT SPC( 40);
00 1580 FOR J = 4 TO 22
00 1590 VTAB J: HTAB 1: PRINT SPC( 1): VTAB J: HTAB
    40: PRINT SPC( 1)
AD 1600 NEXT
32 1610 VTAB 2: HTAB 11: NORMAL : PRINT " PRACTICE S
    ESSION "
5E 1620 VTAB 5: HTAB 4: PRINT "FILE: ";FILE$
6C 1630 VTAB 6: HTAB 3: PRINT "WORDS: ";N
87 1640 VTAB 10: HTAB 3: PRINT "WORD #"
1C 1650 INVERSE
34 1660 VTAB 12: HTAB 13 - LEN (LG$(TYPE)): PRINT LG
    $(TYPE)
51 1670 VTAB 14: HTAB 13 - LEN (LG$(3 - TYPE)): PRIN
    T LG$(3 - TYPE)
5D 1680 VTAB 21: HTAB 10: PRINT "RIGHT";: HTAB 23: P
    RINT "WRONG": NORMAL
02 1690 RETURN
8D 1700 REM PRACTICE
03 1710 R$(0) = "WRONG":R$(1) = "RIGHT":COL(0) = 23:
    COL(1) = 10:N(0) = 0:N(1) = 0
51 1720 FOR I = 1 TO N
33 1730 VTAB 10: HTAB 10: PRINT I
93 1740 VTAB 12: HTAB 14: PRINT SPC( 25): VTAB 14: H
    TAB 14: PRINT SPC( 25)
8A 1750 : REM FIRST WORD
D9 1760 VTAB 12: HTAB 14: PRINT WRD$(I,TYPE)
56 1770 : REM SECOND
72 1780 VTAB 14: HTAB 13: INPUT " ";W$
C5 1790 INVERSE : VTAB 14: HTAB 40: PRINT CHR$ (32):
    NORMAL
8D 1800 : REM RESULT
7F 1810 GOSUB 1840
89 1820 NEXT
ED 1830 RETURN
B6 1840 REM RESULT
D9 1850 V = (W$ = WRD$(I,3 - TYPE))
BF 1860 VTAB 21: HTAB COL(V): FLASH : PRINT R$(V): N
    ORMAL
```

STOP, LOOK, AND LEARN

```
45 1870 N(V) = N(V) + 1
B5 1880 VTAB 21: HTAB COL(V) + 6: PRINT N(V): REM NUMBER RIGHT OR WRONG
F2 1890 IF V = 0 THEN VTAB 17: HTAB 3: INVERSE : PRINT "MEANING";: NORMAL : PRINT CHR$(32) + WRD$(I,3 - TYPE)
7F 1900 VTAB 19: HTAB 14: PRINT "PRESS ANY KEY ";
6A 1910 GET S$
5F 1920 VTAB 17: HTAB 3: PRINT SPC(36): VTAB 19: HTAB 14: PRINT SPC(13)
2D 1930 INVERSE : VTAB 21: HTAB COL(V): PRINT R$(V): NORMAL
F3 1940 RETURN
9C 1950 REM CREATE FILE
75 1960 : REM ENTER NUMBER OF WORDS
93 1970 GOSUB 2070
E4 1980 : REM ENTER FILE NAME
69 1990 GOSUB 1010
79 2000 : REM ASK TO CONTINUE
89 2010 CNT$ = "YES": IF DUP$ = "YES" THEN GOSUB 2170
99 2020 : REM ENTER WORDS
03 2030 IF CNT$ = "YES" THEN GOSUB 2270
46 2040 : REM SAVE DATA
03 2050 IF CNT$ = "YES" THEN GOSUB 2640
EA 2060 RETURN
99 2070 REM # OF WORDS
59 2080 HOME
E0 2090 INVERSE : HTAB (8): PRINT "CREATING A NEW WORD LIST": NORMAL
F2 2100 VTAB 3: HTAB 23: PRINT SPC(10);:CLICK = PEEK(Z)
C5 2110 VTAB 3: HTAB 1: INPUT "NUMBER OF NEW WORDS ?";N$
59 2120 N = INT ( VAL (N$))
57 2130 IF N < 1 THEN 2100
70 2140 IF N > MW THEN VTAB 23: HTAB 11: PRINT "ONLY";MW;" ALLOWED !": GOTO 2100
86 2150 VTAB 23: HTAB 11: PRINT SPC(18)
EC 2160 RETURN
BB 2170 REM DUPLICATE
1D 2180 INVERSE : VTAB 7: HTAB 1: PRINT FILE$;: NORMAL : PRINT " IS ALREADY ON FILE !";BELL$
FC 2190 VTAB 12: HTAB 13: PRINT "WOULD YOU LIKE TO"
78 2200 VTAB 14: HTAB 14: INVERSE : PRINT "1";: NORMAL : PRINT " WRITE OVER IT"
53 2210 VTAB 16: HTAB 14: INVERSE : PRINT "2";: NORMAL : PRINT " RETURN TO MENU"
CE 2220 VTAB 18: HTAB 13: PRINT "CHOICE = ? ";:CLICK = PEEK(Z)
```


STOP, LOOK, AND LEARN

```
65 2230 GET S$
38 2240 CH = VAL (S$): IF CH < 1 OR CH > 2 THEN 2220
44 2250 IF CH = 2 THEN CNT$ = "NO"
EE 2260 RETURN
41 2270 REM ENTER WORDS
85 2280 : REM FORMAT
8A 2290 GOSUB 2350
E6 2300 : REM WORDS
46 2310 FOR I = 1 TO N
7C 2320 GOSUB 2460
7E 2330 NEXT I
E8 2340 RETURN
38 2350 REM FORMAT
57 2360 HOME
94 2370 PRINT "PLEASE ENTER YOUR "; INVERSE : PRINT
    LG$(1);: NORMAL : PRINT " WORDS"
8B 2380 PRINT "AND THEIR "; INVERSE : PRINT LG$(2);
    : NORMAL : PRINT " COUNTERPARTS."
27 2390 INVERSE
05 2400 VTAB 5: HTAB 1: PRINT "WORD #"
86 2410 FOR I = 1 TO 2
78 2420 VTAB 5 + I * 3: HTAB 12 - LEN (LG$(I)): PRIN
    T LG$(I)
86 2430 NEXT
52 2440 NORMAL
EE 2450 RETURN
DE 2460 REM ENTER
E9 2470 VTAB 5: HTAB 8: PRINT I
0B 2480 VTAB 11: HTAB 13: PRINT SPC( 40): VTAB 23: H
    TAB 13: PRINT SPC( 15)
27 2490 FOR J = 1 TO 2
D6 2500 VTAB 5 + J * 3: HTAB 13: PRINT SPC( 40)
39 2510 VTAB 6 + J * 3: HTAB 13: PRINT DLINE$
AB 2520 VTAB 5 + J * 3: HTAB 12
9C 2530 INPUT " ";W$
98 2540 IF W$ = "" THEN 2520
61 2550 IF LEN (W$) > 25 THEN VTAB 23: HTAB 6: PRINT
    "ONLY 25 CHARACTERS ALLOWED !";BELL$;: GOTO
    2500
89 2560 WRD$(I,J) = W$
54 2570 VTAB 23: HTAB 6: PRINT SPC( 28)
97 2580 NEXT J
0E 2590 VTAB 23: HTAB 13: PRINT "CHANGES (Y/N) ? ";:
    CLICK = PEEK (Z)
61 2600 GET S$
0B 2610 IF S$ = "Y" OR S$ = "y" THEN 2480
E5 2620 IF S$ < > "N" AND S$ < > "n" THEN 2590
EA 2630 RETURN
8F 2640 REM SAVE DATA
8A 2650 IF DUP$ = "" THEN NFILES = NFILES + 1:FILE$(
    NFILES) = FILE$
```

STOP, LOOK, AND LEARN

```
05 2660 : REM WORDS
7A 2670 GOSUB 2710
48 2680 : REM CATALOG
8E 2690 GOSUB 2820
E0 2700 RETURN
DA 2710 REM WORDS
01 2720 HOME : VTAB 12: HTAB 14: PRINT "SAVING WORDS
"
B4 2730 PRINT D$; "OPEN" + FILE$
F1 2740 PRINT D$; "WRITE" + FILE$
32 2750 PRINT N
62 2760 FOR I = 1 TO N
D0 2770 PRINT WRD$(I,1); ", "; WRD$(I,2)
D0 2780 NEXT
46 2790 PRINT D$; "CLOSE"
67 2800 M$ = FILE$ + " IS SAVED."
E6 2810 RETURN
49 2820 REM SAVE CATALOG
B3 2830 HOME : VTAB 12: HTAB 12: PRINT "RE-SAVING FI
LE NAMES"
5E 2840 PRINT D$; "OPEN WORDCAT"
3F 2850 PRINT D$; "WRITE WORDCAT"
1C 2860 PRINT NFILES
87 2870 FOR I = 1 TO NFILES
67 2880 PRINT FILE$(I)
D6 2890 NEXT
26 2900 PRINT D$; "CLOSE"
E8 2910 RETURN
D2 2920 REM DELETE A FILE
E1 2930 : REM ENTER NAME
5B 2940 HOME
E1 2950 PRINT "PLEASE ENTER THE NAME OF THE FILE THA
T"
64 2960 PRINT "YOU'D LIKE TO DELETE."
62 2970 GOSUB 1010
A4 2980 : REM DELETE
CE 2990 IF DUP$ = "YES" THEN GOSUB 3040
88 3000 : REM RE-SAVE CATALOG
1E 3010 IF DUP$ = "YES" AND NFILES > 0 THEN GOSUB 28
20
92 3020 IF DUP$ = "YES" AND NFILES = 0 THEN PRINT D$
; "DELETE WORDCAT"
DF 3030 RETURN
A2 3040 REM DELETE
3A 3050 IF ITEM = NFILES THEN 3090
C2 3060 FOR I = ITEM + 1 TO NFILES
B0 3070 FILE$(I - 1) = FILE$(I)
C3 3080 NEXT
AC 3090 NFILES = NFILES - 1
3C 3100 HOME
```


STOP, LOOK, AND LEARN

```
DE 3110 VTAB 12: HTAB 13: PRINT "DELETING WORDS"
29 3120 PRINT D$;"DELETE" + FILE$
90 3130 M$ = FILE$ + " IS DELETED."
E5 3140 RETURN
89 3150 REM SHOW CATALOG
24 3160 FOR I = 1 TO NFILES STEP 15
58 3170 HOME
4A 3180 VTAB 1: HTAB 11: INVERSE : PRINT "WORD LISTS
    ON FILE": NORMAL
99 3190 PRINT
DD 3200 FOR J = I TO I + 14
70 3210 IF J > NFILES THEN 3240
55 3220 L = LEN (FILE$(J))
82 3230 PRINT TAB( 20 - L / 2);FILE$(J)
82 3240 NEXT J
7E 3250 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
72 3260 GET S$
8D 3270 NEXT I
F7 3280 RETURN
```



CHAPTER 5

Personal Record Keeping



5

Personal Record Keeping

This chapter presents two major applications that use your Apple's ability to store and retrieve data. With your Apple and these programs you can improve your record keeping around the house.

Checklist. This program will help you manage household tasks. For example, you may want to set up a checklist for the weekly grocery shopping or you might prepare a checklist itemizing each family member's assigned chores.

Note Taker. The second application is a general-purpose card-file system. You can use it for keeping health records, household inventory, lists of investments, and so on. The possibilities are limitless.

"Checklist" and "Note Taker" use disk data files. Checklist works with a fairly small sequential file. Note Taker, on the other hand, uses random access files. Depending on your use for the program, a Note Taker file may take up most of the available space on a disk.

Before you begin using Checklist and Note Taker, you may want to consider how you'll manage data storage. If you have two disk drives, you can keep all the programs on one disk and the data files on a second disk. If your system has one drive, you'll expend a little more effort. It is best to prepare separate Checklist and Note Taker disks. Place the Checklist programs on one disk and the Note Taker programs on the other. The free space on each disk is then available for data storage. This approach is quite workable. There is still room for fairly good sized data files, and you won't have to do any disk swapping.

Checklist and Note Taker both can produce printed reports, although you don't need a printer with either program. Of course, a printer gives you the important capability of preparing hardcopy reports which can serve as permanent records.

CHECKLIST

Consider the familiar example of a checklist, the grocery list. One category may be dairy products. Within that category are several items.

Dairy Products

- Butter
- Eggs
- Margarine
- Milk (low fat)
- Milk (skim)

A list of household chores is similar. The category may simply be a family member's name.

Dad

- Mow the lawn
- Change the car's oil
- Take a well-earned nap

There are many other situations where keeping a checklist can help you organize your daily tasks.

Program 5-1, CHECKLIST.SETUP, is a special-purpose text-editor program that lets you prepare a checklist and store it on disk. Try to think of all possible checklist entries and use this program to prepare the data file. If you think of more entries later, you can use the program again to add them.

When you start the program, you'll see the main menu as illustrated below. The main menu lets you select from the four major functions.

SET UP A CHECKLIST

DO YOU WANT TO:

1. LOAD A CHECKLIST FILE
2. SAVE A CHECKLIST FILE
3. ADD/CHANGE/DELETE ENTRIES
4. SORT ENTRIES
5. APPLESOFT

TYPE YOUR SELECTION →

Selection 1 asks you for the name of an existing file. If the file is on the disk, it will be loaded into memory and the checklist will be made available to the program. Selection 2

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saves the checklist file on disk. Again, you will be asked for the name of the file that you want to save. Selection 3 makes a checklist file the first time or changes an existing checklist file. Selection 4 sorts the checklist entries within each category. Note that the categories themselves remain in the same order in which they were entered. Thus, when you prepare a grocery list, organize the categories so that they correspond to the way your grocery store is arranged. Selection 5 exits the program and returns control back to Applesoft. You will be warned if you changed a checklist file, but neglected to save the changes.

If you elect to make changes to a checklist file, you will see a second menu screen:

EDIT A CHECKLIST FILE

DO YOU WANT TO:

1. DISPLAY CHECKLIST ENTRIES
2. ADD ENTRIES TO THE CHECKLIST
3. CHANGE CHECKLIST ENTRIES
4. RETURN TO THE MAIN MENU

TYPE YOUR SELECTION →

Selection 1 displays the entire checklist file, 15 entries at a time; you can page forward through the display by pressing Return. Categories are highlighted in inverse video. Use selection 2 when you want to add new entries to the checklist. Entries are added after any that are already on file. Selection 3 changes or deletes existing entries; it can also be used to insert new entries, one at a time, in front of existing ones. Selection 4 brings you back to the main menu.

When you're ready to add information, you will see this display:

ADD CHECKLIST ENTRIES

ENTRY # 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

TYPE IN THE DESIRED ENTRY.

TYPE '*' IN FRONT OF THE ENTRY
TO BEGIN A CATEGORY.

TYPE 'STOP' WHEN YOU ARE FINISHED.

Type the entry where the X's appear. An entry can be a maximum of 38 characters long.

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A category name is an entry with an asterisk as the first character. For example, to establish dairy products as a category, type *DAIRY PRODUCTS. Entries within a category are typed without a leading asterisk.

When you're ready to change entries, you will see another screen:

EDIT CHECKLIST ENTRIES

ENTRY # 1

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

PRESS:

B BACK	I INSERT ENTRY
C CHANGE ENTRY	N DISPLAY # N
D DELETE ENTRY	S STOP
F FORWARD	

Entries are displayed one line at a time. You can move forward or backward through the list by pressing F or B respectively. To make large jumps, press N. The program will ask you for an entry number. For example, type 30 and the thirtieth entry will be displayed.

You can make additions, changes, and deletions. The I command inserts a new entry in front of the entry being displayed. Press C to change an entry. Note that you must retype the entire entry when making a change. To delete an entry, press D while the entry you want to delete is on the screen.

Generally, the program is straightforward and foolproof. There is, however, a limit to the number of entries that the program can handle. You can have up to 1000 entries or 24,000 characters of text—whichever comes first. This should be more than adequate to handle your needs.

Displaying a Checklist

When you go to the grocery store, you don't want to take a list of 700 items with you. Similarly, when you assign your children their weekly chores, you would not expect a great deal of cooperation if the list contained 25 tasks. The real utility of the checklist comes from the fact that it is selective. Rather than containing all possibilities, it contains just what you want at any particular time.

Program 5-2, CHECKLIST.DSPLY, is the checklist display program. It uses the master list prepared by CHECKLIST.SETUP. The display program shows you the master list, category by

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category. You can review and select the items in each category. If you use a printer with the program, you can get a hardcopy. This is a great way of getting a computer-printed grocery list.

When you first run CHECKLIST.DSPLY, it will ask if your printer is ready. If you answer no, the program will assume that you are not using a printer and thus cannot obtain a printed report. If you are using a printer, be sure it is connected and online, and answer accordingly.

Next, you will be asked to supply the name of a checklist file. Type in the name of a file created with CHECKLIST.SETUP and, assuming that the file is present, the checklist will be read into memory.

At this point, you will see the checklist display screen:

DISPLAY A CHECKLIST FILE

CATEGORY: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

```
1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
4 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
8 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
10 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

MOVE CURSOR UP & DOWN TO SELECT ENTRY

N DISPLAY NEXT PAGE

P PRINT ENTRY

Q PRINT ENTRY & QUANTITY

S STOP

HOW MANY?

NEXT COMMAND? →

The program will display up to ten entries within a category at a time. You can page forward by pressing N (next). The display wraps around. So, when you page forward from the last page, the first page will be displayed again.

The up and down arrow keys move an inverse video cursor up and down the screen. Position the cursor on the item that you want. Then, press either the P or Q key; P means to print the list, and Q means you want to print the

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item and quantity. This feature is especially handy for grocery lists or shopping lists.

You can page forward through the list as many times as you want. There is no restriction on the number of times that you can select the same item. It's up to you.

Here is a sample of the printed report from CHECKLIST.DSPY.

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
1	6	APPLES - GOLDEN DELICIOUS
2	1	CEREAL - CORN BRAN
3	1	MUSTARD - HOT
4	1	ICE CREAM - VANILLA

Technical note. If you have an older Apple, you may not have up and down arrow keys on your computer. In this case, use Control-E for up and Control-X for down. The program checks the kind of Apple you're using and makes the cursor up and down adjustments automatically.

Program 5-1. CHECKLIST.SETUP

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
1E 100 REM SET-UP CHECKLIST (CHECKLIST.SETUP)
84 110 REM
4F 120 HOME :D$ = CHR$ (4):CR$ = CHR$ (13): PRINT CH
    R$ (21)
2B 130 CH$ = "N": REM NO CHANGE
2B 140 ME = 1000: REM MAX ENTRIES
20 150 NE = 0: REM # ENTRIES
8C 160 DIM CL$(ME): REM CHECKLIST
1B 170 CF$ = "CHECKLIST"
BE 180 SL$(0) = "1.  LOAD A CHECKLIST FILE"
32 190 SL$(1) = "2.  SAVE A CHECKLIST FILE"
E7 200 SL$(2) = "3.  ADD/CHANGE/DELETE ENTRIES"
9B 210 SL$(3) = "4.  SORT ENTRIES"
52 220 SL$(4) = "5.  APPLESOFT"
08 230 T$ = "S E T - U P      A   C H E C K L I S T"
81 240 N = 4: GOSUB 2760: REM MENU
01 250 IF F = 5 THEN 270
CF 260 ON F GOSUB 630,800,950,2330: GOTO 180
0D 270 IF CH$ = "N" THEN 330
E2 280 VTAB 20: HTAB 1: PRINT "THE CHECKLIST HAS BEE
    N CHANGED,"
0C 290 PRINT "BUT NOT SAVED."
3C 300 PRINT "DO YOU REALLY WANT TO QUIT? ";
7B 310 GOSUB 3220: REM GET Y/N
```


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```
56 320 IF R$ = "N" THEN 180
0A 330 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C7 340 PRINT : PRINT : PRINT
95 350 END
30 360 REM TITLE
92 370 REM
56 380 HOME
91 390 L$ = "": FOR I = 1 TO 40
6F 400 VTAB 1: HTAB 1: PRINT L$
F2 410 VTAB 4: HTAB 1: PRINT L$
C4 420 VTAB 3: HTAB (40 - LEN (TL$)) / 2: PRINT TL$
1A 430 RETURN
A5 440 REM GET FILE NAME
8F 450 REM
5B 460 VTAB 7: HTAB 1: PRINT "TYPE IN THE CHECKLIST
FILE NAME."
60 470 TM$ = CF$
C2 480 RW = 11:CL = 1:SZ = 39: GOSUB 2940: REM SCREE
N READ
21 490 IF TM$ < > "" THEN CF$ = TM$
D2 500 FL$ = CF$
77 510 IF AC$ = "WRITE" THEN 570
F7 520 ONERR GOTO 580
EC 530 VTAB 15: HTAB 1: PRINT SPC( 40)
EF 540 VTAB 16: HTAB 1: PRINT SPC( 40)
D2 550 PRINT D$;"VERIFY ";FL$
EE 560 POKE 216,0: REM NORMAL ERR
23 570 RETURN
F2 580 POKE 216,0: REM NORMAL ERR
A2 590 CALL - 3288: REM FIX STACK
1A 600 VTAB 15: HTAB 1: PRINT "FILE NOT FOUND"
7E 610 VTAB 16: HTAB 1: PRINT "CHECK THE FILE NAME O
R DISKETTE."
19 620 GOTO 440
E2 630 REM LOAD FILE
8F 640 REM
D5 650 TL$ = "LOAD A CHECKLIST FILE": GOSUB 360
3C 660 AC$ = "READ"
B5 670 GOSUB 440: REM GET FILE NAME
D0 680 PRINT D$;"OPEN ";FL$
A8 690 PRINT D$;"READ ";FL$
6B 700 INPUT NE
2A 710 FOR I = 1 TO NE
2B 720 LN$ = ""
12 730 GET C$: IF C$ < > CR$ THEN LN$ = LN$ + C$: GO
TO 730
8B 740 CL$(I) = LN$
37 750 VTAB 13: HTAB 1: PRINT "RECORD ";NE
EF 760 NEXT I
4C 770 PRINT D$;"CLOSE ";FL$
```


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```
FF 780 CH$ = "N"
29 790 RETURN
B0 800 REM SAVE FILE
8B 810 REM
19 820 TL$ = "SAVE A CHECKLIST FILE": GOSUB 360
7E 830 AC$ = "WRITE"
B1 840 GOSUB 440: REM GET FILE NAME
D9 850 PRINT D$;"OPEN ";FL$
4C 860 PRINT D$;"WRITE ";FL$
A4 870 IF NE < 1 THEN 900
52 880 PRINT NE
2A 890 FOR I = 1 TO NE: PRINT CL$(I): NEXT
40 900 PRINT D$;"CLOSE ";FL$
A6 910 VTAB 15: HTAB 1: PRINT "NUMBER OF ENTRIES WRI
      TTEN: ";NE
FF 920 FOR I = 1 TO 2000: NEXT
F7 930 CH$ = "N"
21 940 RETURN
73 950 REM EDIT A CHECKLIST
96 960 REM
B7 970 T$ = "EDIT A CHECKLIST FILE"
0C 980 SL$(0) = "1.  DISPLAY CHECKLIST ENTRIES"
31 990 SL$(1) = "2.  ADD ENTRIES TO THE CHECKLIST"
13 1000 SL$(2) = "3.  CHANGE CHECKLIST ENTRIES"
F3 1010 SL$(3) = "4.  RETURN TO THE MAIN MENU"
68 1020 N = 3: GOSUB 2760: REM MENU
78 1030 IF F = 4 THEN 1060
C6 1040 ON F GOSUB 1070,1270,1500
EE 1050 GOTO 970
E9 1060 RETURN
F5 1070 REM DISPLAY CHECKLIST ENTRIES
D4 1080 REM
F5 1090 TL$ = "DISPLAY CHECKLIST ENTRIES": GOSUB 360
8E 1100 P = 1
9E 1110 PB = P
3E 1120 FOR RW = 6 TO 20
E8 1130 VTAB RW: HTAB 1: PRINT SPC( 40)
01 1140 IF P > NE THEN 1190
19 1150 IF LEFT$( CL$(P),1) = "*" THEN INVERSE
6D 1160 VTAB RW: HTAB 1: PRINT CL$(P)
57 1170 NORMAL
FD 1180 P = P + 1
C7 1190 NEXT
74 1200 VTAB 22: HTAB 1: PRINT SPC( 40)
27 1210 VTAB 22: HTAB 1: PRINT "ENTRIES : ";PB;" - "
      ;P - 1
A1 1220 VTAB 23: HTAB 1: PRINT "PRESS RETURN TO CONT
      INUE ";
E3 1230 GET R$
86 1240 VTAB 23: HTAB 1: PRINT SPC( 40)
```

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```
3E 1250 IF P < = NE THEN 1110
ED 1260 RETURN
62 1270 REM ADD ENTRIES
DB 1280 REM
EA 1290 TL$ = "ADD CHECKLIST ENTRIES": GOSUB 360
32 1300 GOSUB 1410: REM PAINT ADD SCREEN
BB 1310 FOR I = NE + 1 TO ME
19 1320 GOSUB 2700: IF MF < > 0 THEN 1400
BB 1330 VTAB 6: HTAB 9: PRINT RIGHT$ ("      " + STR$
      (I),4)
AF 1340 TM$ = "":RW = 8:CL = 1:SZ = 38: GOSUB 2940:
      REM SCREEN READ
77 1350 IF TM$ = "" THEN 1340
4D 1360 IF TM$ = "STOP" OR TM$ = "stop" THEN 1400
AE 1370 CL$(I) = TM$:NE = NE + 1
BF 1380 CH$ = "Y"
CB 1390 NEXT
D9 1400 RETURN
CB 1410 REM PAINT ADD SCREEN
C4 1420 REM
35 1430 VTAB 6: HTAB 1: PRINT "ENTRY #"
EF 1440 VTAB 10: HTAB 1: FOR I = 1 TO 39: PRINT "_";
      : NEXT : PRINT
70 1450 VTAB 12: HTAB 1: PRINT "TYPE IN THE DESIRED
      ENTRY."
5F 1460 VTAB 13: HTAB 1: PRINT "TYPE '*' IN FRONT OF
      THE ENTRY"
41 1470 VTAB 14: HTAB 1: PRINT "TO BEGIN A CATEGORY.
      "
8D 1480 VTAB 15: HTAB 1: PRINT "TYPE 'STOP' WHEN YOU
      ARE FINISHED."
FD 1490 RETURN
DD 1500 REM EDIT CHECKLIST
C2 1510 REM
6B 1520 TL$ = "EDIT CHECKLIST ENTRIES": GOSUB 360
73 1530 GOSUB 1730: REM PAINT SCREEN
A6 1540 P = 1
D7 1550 IF NE > 0 THEN 1590
66 1560 VTAB 18: HTAB 1: PRINT "** THERE ARE NO CHEC
      KLIST ENTRIES. **"
BD 1570 FOR I = 1 TO 2000: NEXT
BA 1580 GOTO 1720
DD 1590 VTAB 6: HTAB 9: PRINT RIGHT$ ("      " + STR$
      (P),4)
1A 1600 VTAB 8: HTAB 1: PRINT SPC( 39): VTAB 8: HTAB
      1: PRINT CL$(P)
A0 1610 VTAB 12: HTAB 9
3D 1620 GET C$: IF C$ = "" THEN 1620
89 1630 PRINT
D2 1640 IF C$ = "B" OR C$ = "b" THEN GOSUB 1860
```

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```
1C 1650 IF C$ = "C" OR C$ = "c" THEN GOSUB 1900
2B 1660 IF C$ = "D" OR C$ = "d" THEN GOSUB 1960
9C 1670 IF C$ = "F" OR C$ = "f" THEN GOSUB 2050
8A 1680 IF C$ = "I" OR C$ = "i" THEN GOSUB 2090
E5 1690 IF C$ = "N" OR C$ = "n" THEN GOSUB 2260
8C 1700 IF C$ = "S" OR C$ = "s" THEN 1720
7A 1710 GOTO 1550
E7 1720 RETURN
1F 1730 REM PAINT SCREEN
D2 1740 REM
43 1750 VTAB 6: HTAB 1: PRINT "ENTRY #"
FD 1760 VTAB 10: HTAB 1: FOR I = 1 TO 39: PRINT "_";
: NEXT I: PRINT
91 1770 VTAB 12: HTAB 1: PRINT "PRESS:"
22 1780 VTAB 13: HTAB 1: PRINT "B BACK"
01 1790 VTAB 13: HTAB 20: PRINT "I INSERT ENTRY"
00 1800 VTAB 14: HTAB 1: PRINT "C CHANGE ENTRY"
10 1810 VTAB 14: HTAB 20: PRINT "N DISPLAY # N"
8A 1820 VTAB 15: HTAB 1: PRINT "D DELETE ENTRY"
DA 1830 VTAB 15: HTAB 20: PRINT "S STOP"
A7 1840 VTAB 16: HTAB 1: PRINT "F FORWARD"
F5 1850 RETURN
86 1860 REM BACK
E0 1870 REM
83 1880 P = P - 1: IF P < 1 THEN P = 1
06 1890 RETURN
CA 1900 REM CHANGE
CA 1910 REM
FB 1920 TM$ = CL$(P)
32 1930 RW = 8:CL = 1:SZ = 38: GOSUB 2940: REM SCREE
N READ
CA 1940 IF TM$ < > "" THEN CL$(P) = TM$:CH$ = "Y"
F7 1950 RETURN
8A 1960 REM DELETE
E2 1970 REM
AB 1980 FOR I = P TO NE - 1
3D 1990 CL$(I) = CL$(I + 1)
A2 2000 NEXT
21 2010 CL$(NE) = ""
4E 2020 NE = NE - 1: IF NE < 0 THEN NE = 0
A6 2030 CH$ = "Y"
E2 2040 RETURN
D5 2050 REM FORWARD
CD 2060 REM
6C 2070 P = P + 1: IF P > NE THEN P = 1
F2 2080 RETURN
30 2090 REM INSERT
B7 2100 REM
B5 2110 IF NE > = ME THEN 2220
38 2120 GOSUB 2700: IF MF < > 0 THEN 2250
```

PERSONAL RECORD KEEPING

```
A5 2130 FOR I = NE TO P STEP - 1
B3 2140 CL$(I + 1) = CL$(I)
B8 2150 NEXT
B4 2160 TM$ = " ":RW = 8:CL = 1:SZ = 38: GOSUB 2940:
    REM SCREEN READ
B1 2170 IF TM$ = "" THEN 2160
05 2180 CL$(P) = TM$
E3 2190 NE = NE + 1: IF NE > ME THEN NE = ME
9E 2200 CH$ = "Y"
6C 2210 GOTO 2250
70 2220 VTAB 18: HTAB 1: PRINT "*** THE CHECKLIST IS
    FULL ***"
A8 2230 FOR I = 1 TO 2000: NEXT
90 2240 VTAB 18: HTAB 1: PRINT SPC( 40)
EA 2250 RETURN
8D 2260 REM REC # N
D5 2270 REM
8C 2280 TM$ = STR$(P)
99 2290 RW = 6:CL = 9:SZ = 4: GOSUB 2940: REM SCREEN
    READ
22 2300 IF TM$ < > "" THEN P = VAL (TM$)
C6 2310 IF P < 1 OR P > NE THEN 2280
E0 2320 RETURN
37 2330 REM SORT ENTRIES
CB 2340 REM
F3 2350 TL$ = "SORT CHECKLIST ENTRIES WITHIN CATEGOR
    Y": GOSUB 360
13 2360 VTAB 8: HTAB 1: PRINT "SORTING MAY TAKE A FE
    W MINUTES."
17 2370 PB = 1: REM FIND CATEGORY START
D5 2380 IF PB > NE THEN 2510
FB 2390 IF LEFT$(CL$(PB),1) = "*" THEN 2420
82 2400 PB = PB + 1
7E 2410 GOTO 2380
B2 2420 PE = PB + 1: REM FIND CATEGORY END
54 2430 CT$ = CL$(PB)
56 2440 IF PE > NE THEN 2480
F9 2450 IF LEFT$(CL$(PE),1) = "*" THEN 2480
FD 2460 PE = PE + 1
88 2470 GOTO 2440
05 2480 GOSUB 2540: REM SORT ENTRIES
8B 2490 PB = PE
7C 2500 GOTO 2380
F8 2510 VTAB 16: HTAB 1: PRINT "CHECKLIST HAS BEEN S
    ORTED."
AA 2520 FOR I = 1 TO 2000: NEXT
E8 2530 RETURN
36 2540 REM SORT WITHIN PB,PE
01 2550 IF PE - PB < 3 THEN
```

PERSONAL RECORD KEEPING

```
C3 2560 VTAB 12: HTAB 1: PRINT SPC( 40): VTAB 12: HT
    AB 1: PRINT "SORTING CATEGORY:"
99 2570 VTAB 14: HTAB 1: PRINT SPC( 40): VTAB 14: HT
    AB 1: PRINT MID$(CT$,2)
7B 2580 P1 = PB + 1:P2 = PE - 1
DA 2590 F = 0
82 2600 FOR K = P1 TO P2 - 1
58 2610 IF CL$(K) <= CL$(K + 1) THEN 2660
55 2620 T$ = CL$(K)
23 2630 CL$(K) = CL$(K + 1)
A2 2640 CL$(K + 1) = T$
0D 2650 F = 1
C6 2660 NEXT
75 2670 IF F = 1 THEN 2590
C6 2680 CH$ = "Y"
03 2690 RETURN
92 2700 REM CHECK FOR ROOM
2B 2710 TL = 0: FOR Z = 1 TO NE: TL = TL + LEN (CL$(Z
    )): NEXT
IF 2720 MF = 0: IF TL < 24000 THEN 2750
0F 2730 VTAB 22: HTAB 1: PRINT "** MEMORY IS FULL **
    "
8C 2740 MF = 1: FOR ZI = 1 TO 2000: NEXT
F4 2750 RETURN
90 2760 REM -- MENU SUBROUTINE
05 2770 HOME : ZL$ = ""
27 2780 FOR ZI = 1 TO 40: ZL$ = ZL$ + "_": NEXT
98 2790 VTAB 1: PRINT ZL$
79 2800 VTAB 4: PRINT ZL$
CE 2810 VTAB 3: HTAB (40 - LEN (T$)) / 2: PRINT T$
09 2820 VTAB 6: PRINT "DO YOU WANT TO:"
96 2830 LET ZR = 8: ZC = 2
8A 2840 FOR ZI = 0 TO N
F3 2850 VTAB ZR + ZI: HTAB ZC: PRINT SL$(ZI)
CA 2860 NEXT
29 2870 VTAB ZR + N + 4: PRINT ZL$
02 2880 VTAB ZR + N + 2: PRINT "TYPE YOUR SELECTION
    --> ";
90 2890 GET ZC$: IF ZC$ < "1" OR ZC$ > STR$(N + 1)
    THEN 2890
38 2900 LET F = VAL (ZC$)
6B 2910 INVERSE : VTAB ZR + F - 1: HTAB ZC: PRINT SL
    $(F - 1): NORMAL
6D 2920 FOR ZI = 1 TO 500: NEXT
F0 2930 RETURN
67 2940 REM -- LINE INPUT WITH TEMPLATE DRIVER
7B 2950 GOSUB 3000: REM LINE INPUT
4B 2960 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$(13);
02 2970 IF R$ < > "" THEN TM$ = R$
```

PERSONAL RECORD KEEPING

```
62 2980 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
    (13);
89 2990 RETURN
08 3000 REM -- LINE INPUT SUBROUTINE
59 3010 LET ZT$ = TM$:R$ = "":ZP = 0
66 3020 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
28 3030 PRINT CHR$ (25): VTAB RW: HTAB CL: INVERSE :
    PRINT ZT$;
67 3040 PRINT CHR$ (25): VTAB RW: HTAB CL
56 3050 GET ZC$
02 3060 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
4F 3070 IF ZC$ = CHR$ (24) THEN 3010: REM CTRL-X
35 3080 IF ZC$ = CHR$ (8) THEN 3140: REM LEFT ARROW
73 3090 IF ZC$ = CHR$ (13) THEN 3190: REM CR
FF 3100 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    3050
01 3110 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
28 3120 LET ZP = ZP + 1: IF ZP > = SZ THEN 3190
70 3130 GOTO 3050
E1 3140 HTAB CL + ZP: PRINT " ";:ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
BF 3150 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
27 3160 IF LEN (R$) < = 1 THEN R$ = ""
04 3170 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
    ) - 1)
84 3180 GOTO 3050
53 3190 NORMAL : REM CR
7F 3200 PRINT CHR$ (13);
08 3210 RETURN
95 3220 REM -- GET Y OR N SUBROUTINE
73 3230 GET R$: IF R$ = "" THEN 3230
6A 3240 IF R$ = "n" THEN R$ = "N"
48 3250 IF R$ = "y" THEN R$ = "Y"
22 3260 IF R$ < > "N" AND R$ < > "Y" THEN 3230
CB 3270 PRINT R$
F7 3280 RETURN
```

Program 5-2. CHECKLIST.DSPLY

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
E2 100 REM DISPLAY CHECKLIST (CHECKLIST.DSPLY)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
7D 130 CR$ = CHR$ (13): REM RETURN
28 140 ME = 1000: REM MAX ENTRIES
20 150 NE = 0: REM # ENTRIES
```


PERSONAL RECORD KEEPING

```
8C 160 DIM CL$(ME): REM CHECKLIST
BA 170 GOSUB 1980: REM SET CURSOR VALUES
59 180 GOSUB 280
DD 190 VTAB 12: HTAB 1: PRINT "IS THE PRINTER READY
(Y/N)? ";
D0 200 GOSUB 2320: PS$ = R$
10 210 CF$ = "CHECKLIST"
8D 220 GOSUB 330: REM LOAD CHECKLIST FILE
40 230 GOSUB 690: REM DISPLAY ENTRIES
95 240 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU."
C8 250 PRINT : PRINT : PRINT
96 260 END
91 270 REM
33 280 REM TITLE
57 290 HOME
5D 300 T$ = "DISPLAY A CHECKLIST FILE"
08 310 VTAB 1: HTAB (40 - LEN (T$)) / 2: PRINT T$
17 320 RETURN
17 330 REM LOAD CHECKLIST FILE
8C 340 REM
C3 350 GOSUB 280: REM TITLE
B9 360 GOSUB 390: REM GET FILE NAME
32 370 GOSUB 560: REM LOAD FILE
23 380 RETURN
AE 390 REM GET FILE NAME
4F 400 VTAB 7: HTAB 1: PRINT "TYPE IN THE CHECKLIST
FILE NAME."
54 410 TM$ = CF$
92 420 RW = 11: CL = 1: SZ = 39: GOSUB 2040: REM SCREE
N READ
15 430 IF TM$ < > "" THEN CF$ = TM$
D9 440 FL$ = CF$
1C 450 ONERR GOTO 510
F1 460 VTAB 15: HTAB 1: PRINT SPC( 40)
F4 470 VTAB 16: HTAB 1: PRINT SPC( 40)
D7 480 PRINT D$; "VERIFY "; FL$
F3 490 POKE 216,0: REM NORMAL ERR
15 500 RETURN
E4 510 POKE 216,0: REM NORMAL ERR
94 520 CALL - 3288: REM FIX STACK
1F 530 VTAB 15: HTAB 1: PRINT "FILE NOT FOUND"
83 540 VTAB 16: HTAB 1: PRINT "CHECK THE FILE NAME O
R DISKETTE."
A2 550 GOTO 390
E7 560 REM LOAD FILE
94 570 REM
DC 580 PRINT D$; "OPEN "; FL$
A7 590 PRINT D$; "READ "; FL$
6A 600 INPUT NE
29 610 FOR I = 1 TO NE
```

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```

2A 620 LN$ = ""
F0 630 GET C$: IF C$ < > CR$ THEN LN$ = LN$ + C$: GO
    TO 630
8A 640 CL$(I) = LN$
12 650 VTAB 13: HTAB 1: PRINT "RECORD "; I
0A 660 NEXT
4B 670 PRINT D$; "CLOSE "; FL$
26 680 RETURN
F6 690 REM DISPLAY ENTRIES
8B 700 REM
BF 710 GOSUB 280: REM TITLE
AE 720 IT = 0: GOSUB 1830: REM HEADERS
DC 730 GOSUB 890: REM PAINT SCREEN
35 740 P = 1: CT$ = "": KT = 0
4A 750 GOSUB 1010: REM DISPLAY CATEGORY
1F 760 GOSUB 1100: REM DISPLAY PANEL
E5 770 IF P > NE THEN P = 1
4D 780 Y = 5
79 790 GOSUB 1230: REM INVERSE SELECTED ENTRY
2E 800 VTAB 23: HTAB 18: GET C$: VTAB 1: HTAB 1: PRI
    NT
85 810 IF C$ = CU$ THEN GOSUB 1290: GOTO 800
45 820 IF C$ = CD$ THEN GOSUB 1380: GOTO 800
B2 830 IF C$ = "N" OR C$ = "n" THEN 750
53 840 IF C$ = "P" OR C$ = "p" THEN GOSUB 1470: GOTO
    800
B9 850 IF C$ = "Q" OR C$ = "q" THEN GOSUB 1580: GOTO
    800
#5 860 IF C$ = "S" OR C$ = "s" THEN GOSUB 1740: GOTO
    880
23 870 GOTO 800
2B 880 RETURN
C3 890 REM PAINT SCREEN
8A 900 REM
5C 910 VTAB 3: HTAB 1: PRINT "CATEGORY:"
25 920 VTAB 15: HTAB 1: FOR I = 1 TO 39: PRINT "_";:
    NEXT I: PRINT
02 930 VTAB 17: HTAB 1: PRINT "MOVE CURSOR UP & DOWN
    TO SELECT ENTRY"
6B 940 VTAB 18: HTAB 1: PRINT "N    DISPLAY NEXT PAGE
    "
73 950 VTAB 19: HTAB 1: PRINT "P    PRINT ENTRY"
4E 960 VTAB 20: HTAB 1: PRINT "Q    PRINT ENTRY & QUA
    NTITY"
C2 970 VTAB 21: HTAB 1: PRINT "S    STOP"
63 980 VTAB 22: HTAB 1: PRINT "HOW MANY?"
4D 990 VTAB 23: HTAB 1: PRINT "NEXT COMMAND? ->"
D1 1000 RETURN
C5 1010 REM DISPLAY CATEGORY
BC 1020 REM

```

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```
C3 1030 IF LEFT$ (CL$(P),1) < > "*" THEN 1070
23 1040 CT$ = MID$ (CL$(P),2)
0E 1050 KT = 0
F3 1060 P = P + 1
12 1070 VTAB 3: HTAB 13: PRINT SPC( 27)
FD 1080 VTAB 3: HTAB 13: PRINT LEFT$ (CT$,27)
F5 1090 RETURN
2E 1100 REM DISPLAY PANEL
BA 1110 REM
A2 1120 PB = P
1F 1130 FOR RW = 5 TO 14
EC 1140 VTAB RW: HTAB 1: PRINT SPC( 40)
7D 1150 IF P > NE THEN 1210
48 1160 IF LEFT$ (CL$(P),1) = "*" THEN 1210
19 1170 KT = KT + 1
71 1180 N$ = RIGHT$ ("      " + STR$ (KT),4)
BA 1190 VTAB RW: HTAB 1: PRINT N$;" "; LEFT$ (CL$(P
),34)
FA 1200 P = P + 1:RE = RW
A9 1210 NEXT
DD 1220 RETURN
5F 1230 REM INVERSE SELECTED ENTRY
CB 1240 REM
14 1250 INVERSE
59 1260 VTAB Y: HTAB 7: PRINT LEFT$ (CL$(PB + Y - 5)
,34)
59 1270 NORMAL
F5 1280 RETURN
F5 1290 REM UP ARROW
BA 1300 REM
43 1310 NORMAL
48 1320 VTAB Y: HTAB 7: PRINT LEFT$ (CL$(PB + Y - 5)
,34)
A7 1330 Y = Y - 1: IF Y < 5 THEN Y = RE
12 1340 INVERSE
57 1350 VTAB Y: HTAB 7: PRINT LEFT$ (CL$(PB + Y - 5)
,34)
57 1360 NORMAL
F3 1370 RETURN
6D 1380 REM DOWN ARROW
DE 1390 REM
41 1400 NORMAL
49 1410 VTAB Y: HTAB 7: PRINT LEFT$ (CL$(PB + Y - 5)
,34)
55 1420 Y = Y + 1: IF Y > RE THEN Y = 5
10 1430 INVERSE
55 1440 VTAB Y: HTAB 7: PRINT LEFT$ (CL$(PB + Y - 5)
,34)
55 1450 NORMAL
F1 1460 RETURN
38 1470 REM PRINT ENTRY
```

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```

DC 1480 REM
E7 1490 IF PS$ = "N" THEN 1570
B0 1500 IT = IT + 1: T$ = RIGHT$ ("      " + STR$ (IT),
    4)
70 1510 IF LC > 55 THEN GOSUB 1920: GOSUB 1830
3F 1520 PRINT D$;"PR#1"
9D 1530 HTAB 1: PRINT T$;
BB 1540 HTAB 19: PRINT CL$(PB + Y - 5)
4A 1550 PRINT D$;"PR#0"
7A 1560 LC = LC + 1
F7 1570 RETURN
C9 1580 REM PRINT ENTRY W/QUANTITY
E2 1590 REM
AF 1600 IF PS$ = "N" THEN 1730
7D 1610 TM$ = " ": RW = 22: CL = 12: SZ = 4: GOSUB 2040
6B 1620 IF TM$ = "" THEN 1610
3A 1630 Q = VAL (TM$): Q$ = RIGHT$ ("      " + STR$ (Q),
    4)
9F 1640 IT = IT + 1: T$ = RIGHT$ ("      " + STR$ (IT),
    4)
B2 1650 IF LC > 55 THEN GOSUB 1920: GOSUB 1830
51 1660 PRINT D$;"PR#1"
AF 1670 HTAB 1: PRINT T$;
93 1680 HTAB 10: PRINT Q$;
D1 1690 HTAB 19: PRINT CL$(PB + Y - 5)
3A 1700 PRINT D$;"PR#0"
6A 1710 LC = LC + 1
45 1720 VTAB 22: HTAB 12: PRINT "      "
EB 1730 RETURN
2A 1740 REM STOP CLOSE FILES
D6 1750 REM
BD 1760 IF PS$ = "N" THEN 1810
57 1770 PRINT D$;"PR#1"
AF 1780 PRINT CHR$ (12)
5E 1790 PRINT D$;"PR#0"
23 1800 PRINT D$;"CLOSE"
E5 1810 RETURN
CC 1820 REM
5E 1830 REM REPT HEADERS
BB 1840 IF PS$ = "N" THEN 1910
51 1850 PRINT D$;"PR#1"
CA 1860 PRINT "ITEM      QUANTITY      DESCRIPTION"
CC 1870 PRINT "-----"
A1 1880 PRINT
60 1890 PRINT D$;"PR#0"
FB 1900 LC = 3
E7 1910 RETURN
8E 1920 REM PAGE EJECT
D2 1930 REM
4F 1940 PRINT D$;"PR#1"
A7 1950 PRINT CHR$ (12)

```

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```
56 1960 PRINT D$;"PR#0"
FF 1970 RETURN
C0 1980 REM SET CURSOR MOVEMENT VALUES
EA 1990 REM
6A 2000 CU$ = CHR$ (11):CD$ = CHR$ (10)
9D 2010 IF PEEK (64435) = 06 THEN 2030: REM IIE OR I
    IC
77 2020 CU$ = CHR$ (05):CD$ = CHR$ (24)
DE 2030 RETURN
55 2040 REM -- LINE INPUT WITH TEMPLATE DRIVER
6B 2050 GOSUB 2100: REM LINE INPUT
39 2060 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
C0 2070 IF R$ < > "" THEN TM$ = R$
50 2080 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
    (13);
F6 2090 RETURN
D9 2100 REM -- LINE INPUT SUBROUTINE
5A 2110 LET ZT$ = TM$:R$ = "":ZP = 0
67 2120 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
29 2130 PRINT CHR$ (25): VTAB RW: HTAB CL: INVERSE :
    PRINT ZT$;
6B 2140 PRINT CHR$ (25): VTAB RW: HTAB CL
57 2150 GET ZC$
D3 2160 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
90 2170 IF ZC$ = CHR$ (24) THEN 2110: REM CTRL-X
56 2180 IF ZC$ = CHR$ (8) THEN 2240: REM LEFT ARROW
B4 2190 IF ZC$ = CHR$ (13) THEN 2290: REM CR
21 2200 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    2150
02 2210 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
34 2220 LET ZP = ZP + 1: IF ZP > = SZ THEN 2290
72 2230 GOTO 2150
E2 2240 HTAB CL + ZP: PRINT " ";;ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
C0 2250 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
2B 2260 IF LEN (R$) < = 1 THEN R$ = ""
C5 2270 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
    ) - 1)
86 2280 GOTO 2150
54 2290 NORMAL : REM CR
80 2300 PRINT CHR$ (13);
DC 2310 RETURN
96 2320 REM --- GET Y OR N SUBROUTINE
94 2330 GET R$: IF R$ = "" THEN 2330
6B 2340 IF R$ = "n" THEN R$ = "N"
4C 2350 IF R$ = "y" THEN R$ = "Y"
2B 2360 IF R$ < > "N" AND R$ < > "Y" THEN 2330
CC 2370 PRINT R$
FB 2380 RETURN
```

NOTE TAKER

Note Taker is the equivalent of the desktop index card file. Just as you can write whatever you want on index cards, you can type and store whatever you want with Note Taker. Index cards can be arranged in categories to build a filing scheme. The same is true of Note Taker records. You can search through an index card file, find what you want, and transfer the information somewhere else. You can do the same with Note Taker, but you can go a step further and obtain printouts if you have access to a printer. Note Taker is a great way of taking care of your home, school, and office information storage needs.

A Note Taker file consists of one or more records or entries related to a particular subject. You might set up a Note Taker file for medical records, household inventory, record collections, stock purchases, or automobile maintenance. You can even use it to keep track of your favorite articles from computer magazines.

Let's take a look at how Note Taker organizes information. An entry can contain from one to five lines of 30 characters each, or a maximum of 150 characters. Associated with each entry are three categories labeled Category 1, Category 2, and Category 3. Each category can contain up to 24 characters. The categories are a way of organizing and classifying information. Five lines of text may not seem like a lot. If you need more than this, just use Category 3 as a page number. This technique is a useful trick if you have that much text to store.

These two examples from a Note Taker file of medical records will give you an idea of how information can be organized.

CATEGORY 1: DAD

CATEGORY 2: FLU

CATEGORY 3: 85/02

1. COUGH, RUNNY NOSE, TEMP. 103
2. TOOK ASPIRIN, STAYED HOME 2 DAYS.
3. TREATED BY DR. KILDARE
- 4.
- 5.

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CATEGORY 1: DAUGHTER
CATEGORY 2: CHICKEN POX
CATEGORY 3: 85/03

1. TYPICAL SYMPTOMS - MILD RASH
2. NO ASPIRIN GIVEN
3. STAYED HOME 1 WEEK
4. TREATED BY DR. WELBY
- 5.

The categories record family member, type of illness, and month. Note that the dates are in year/month format. This guarantees that records will be in proper order when the file is sorted. The notes themselves describe details pertinent to the illness.

By establishing the categories this way, you can search the medical records later by family member, illness, or date. For example, a search can find the father's complete medical records. Or a search can list all the family members who had flu. The categories provide for subsequent extraction of information. In this particular example, since the doctor treating the illness is not one of the categories, if you search for Dr. Kildare, every Note Taker record will have to be examined, one by one.

Note Taker records are stored on disk as random access files. A record number is assigned to each entry. Record numbers range from one to the maximum number of records allocated for a particular file. These are displayed on the screen when you use Note Taker. You don't have to be too concerned with the record number of an entry, however. Just think of the record number as that entry's position within the file, since sorting the file results in entries being given new record numbers.

Note Taker is composed of six programs, which will be discussed in the sections that follow:

NOTER.SETUP	Program 5-3	Set up a new note file
NOTER.ADD	Program 5-4	Add entries to a note file
NOTER.CHANGE	Program 5-5	Change existing entries
NOTER.SORT	Program 5-6	Sort a note file
NOTER.SEARCH	Program 5-7	Search a note file; print notes
NOTER.EXPAND	Program 5-8	Enlarge a note file

Making a New Note File

A Note Taker file must be initialized with the program `NOTER.SETUP` before you can use the file. Initializing gives the Note Taker file a name and reserves space on the disk for it. You may use any name you like, but it should suggest the contents of the file. For example, `TREASURY.BONDS` gives you a better idea of what the file contains than does `FILE1`. Specify the maximum number of records that your file will contain. The initialization process makes sure there is enough room.

`NOTER.SETUP` will ask you for a filename. Follow the appropriate DOS or ProDOS filename conventions. If the filename has already been used on the disk, `NOTER.SETUP` will warn you. You may certainly reinitialize a file, but doing so completely and permanently destroys whatever data was there. *Watch what you are doing.*

Next, `NOTER.SETUP` asks you for the maximum number of notes or records that will be on the file. Of course, you may not know the exact number. You may have a maximum of 500 records, which will take up almost an entire disk. It's a good idea to limit the maximum to under 250 records, especially if you plan to sort the file. You'll need room on the disk to hold both the original file and the sorted file.

What if your information needs seem too big? Try establishing separate note files. For example, make one file for your Bach and Beethoven records. Combine all the other records in a separate file.

`NOTER.SETUP` will write a blank record for the number of records that you specified. It may take `NOTER.SETUP` a few minutes to complete the process. If there isn't enough room on the disk, the computer will let you know. You can either ask for a smaller file size or try again with another formatted disk. `NOTER.SETUP` will display a message if the file has been successfully initialized. At this point, you are ready to add notes to the file.

Warning: If you run out of room on a Note Taker file, you can safely expand the file with `NOTER.EXPAND`. Do not attempt to use `NOTER.SETUP` for this purpose.

Adding Notes

Add notes to the file by using the program `NOTER.ADD`. New notes are added to the file after the notes that are already

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present. NOTER.SORT can sort the file by category if you need the records in a particular order.

NOTER.ADD begins by asking you for a filename. Type in the name of a previously initialized file, and the program will check to make sure that the file exists.

The screen display for adding notes is shown below. You must make an entry in Category 1, but all the other fields are optional. If you want to skip a field, press Return. The inverse video cursor will position itself to the next field.

```
CATEGORY 1: XXXXXXXXXXXXXXXXXXXXXXXX
CATEGORY 2: XXXXXXXXXXXXXXXXXXXXXXXX
CATEGORY 3: XXXXXXXXXXXXXXXXXXXXXXXX
```

```
1 XXXXXXXXXXXXXXXXXXXXXXXX
2 XXXXXXXXXXXXXXXXXXXXXXXX
3 XXXXXXXXXXXXXXXXXXXXXXXX
4 XXXXXXXXXXXXXXXXXXXXXXXX
5 XXXXXXXXXXXXXXXXXXXXXXXX
```

```
TYPE 'STOP' IN CATEGORY 1
WHEN YOU ARE FINISHED.
```

```
RECORD 1 OF 25
```

```
OK TO ADD (Y/N)?
```

When you've finished with the fifth line, NOTER.ADD asks if you want to add the record. You may decide not to add the record because of a typing mistake. The cursor will be positioned back at Category 1. Press Return if you want to accept the field as is. *Otherwise, retype the entire field.*

When you add a record, the record count will be updated. NOTER.ADD keeps track of what record you're working on and how much room is left in the Note Taker file. If the file should fill up, you will see an error message from NOTER.ADD, and you will be unable to add records. This is a good time to run NOTER.EXPAND.

When you finish typing a series of notes, enter STOP in Category 1. NOTER.ADD will close the Note Taker file and make sure that everything is in good shape. Of course, you can resume adding notes later. NOTER.ADD knows how many records have been typed in and it will let you pick up where you left off; this keeps you from having to add all the notes at once.

Changing Notes

Information changes. Whatever the reason, you will almost certainly find a need for going back and changing information in a Note Taker file.

The program NOTER.CHANGE is the Note Taker file update program. It can display notes and let you either change or erase them. However, NOTER.CHANGE does not provide for adding new records.

NOTER.CHANGE also begins by asking you for the name of a note file. Assuming that the Note Taker file can be found, it checks to see if there are any notes on the file. If not, there is no point in attempting to change one, and NOTER.CHANGE will make a quick exit.

The change display is similar to the add display:

```
CATEGORY 1: XXXXXXXXXXXXXXXXXXXXXXXX
CATEGORY 2: XXXXXXXXXXXXXXXXXXXXXXXX
CATEGORY 3: XXXXXXXXXXXXXXXXXXXXXXXX
```

```
1 XXXXXXXXXXXXXXXXXXXXXXXX
2 XXXXXXXXXXXXXXXXXXXXXXXX
3 XXXXXXXXXXXXXXXXXXXXXXXX
4 XXXXXXXXXXXXXXXXXXXXXXXX
5 XXXXXXXXXXXXXXXXXXXXXXXX
```

RECORD 1 OF 25

PRESS:

BACK CHANGE ERASE FORWARD GET.# QUIT

The record number indicates the position of the entry within the Note Taker file. You can display other notes by pressing F or B to move forward or backward through the file. The display wraps around. If you press F while looking at the last record, for example, the first record will be displayed.

If your file is large, it may be tedious to search through the file record by record. In this case, use the G (get) command. NOTER.CHANGE will request a record number. Type one in, and that record will be displayed. You can display any entry immediately if you know its record number.

When you've located the desired entry, press C (change) if you want to change it. The inverse video cursor will position itself at Category 1. Press Return if you want to accept a field as displayed. Otherwise, retype the entire field. After you've been through all the fields, you will be asked to confirm the change.

The E (erase) command erases an entry. Before erasing an entry, `NOTER.CHANGE` will request confirmation. When an entry is erased, all of its fields are blanked out. The entry itself is still in the file, however. You can use the C command to place other information in the now blank entry. This allows you to reuse an entry.

When you have finished making changes, press Q (quit). `NOTER.CHANGE` will return control to Applesoft.

Sorting Notes

When you add notes to a Note Taker file, the new notes are placed at the end of the file. The last note typed in is the last note in the file. Depending on your specific application, this may not be exactly what you want.

`NOTER.SORT` sorts a Note Taker file in ascending order by Categories 1, 2, and 3. Using the earlier example of a medical records file, notes would be sorted by family member, name of illness, and date of illness.

You should enter data with this sorting method in mind. First of all, be consistent. Always enter Dad as *DAD*, not sometimes as *FATHER*. Similarly, use only one name for the same illness—*FLU* is not the same as *INFLUENZA* to the computer. Be careful about dates—enter them in year, month, day format, for example, 850205 or 85/02/05. Dates entered in this way will sort properly. Since this can be troublesome, you might consider using just the year as a category and keeping the full date as part of the notes themselves. Use a leading zero to make all numbers two digits long.

Similar considerations hold for page numbers if you use them as categories. Enter them as *PAGE 1* or as *PAGE 01* if you think you will exceed nine pages for a particular entry. Unexpected results from a sort can often be traced back to the way the categories were originally entered.

Before sorting a Note Taker file, make sure you have enough room on your data disk for an entire copy of the file.

`NOTER.SORT` works by making a sorted copy of the file and leaving the original file intact. This technique prevents an accidental power outage or a disk error from ruining your day. Assuming that the sort was successful, you may delete the original file and rename the sorted file.

When you run `NOTER.SORT`, it will ask you for the name of the file you want to sort. Type in the name of a Note

Taker file. NOTER.SORT will see if the file is on the data disk. If not, you will be asked to retype the filename.

Next, NOTER.SORT asks you for the name of the sorted file. Type in another filename. Note that you cannot use the same name as the input file. NOTER.SORT will warn you if you specify the name of a file that already exists.

NOTER.SORT initializes the output file in the same way as NOTER.SETUP. NOTER.SORT verifies that the disk has enough room for the sorted file. If there is insufficient room, you will see an error message and the sort will end.

If all is well up to this point, NOTER.SORT will begin the sort. The three categories are read from the input file and stored in an array. The record number of each record is also stored in an array. The program uses a shell sort (a fast sorting algorithm), placing the three categories in alphabetical order and rearranging the array of record numbers.

So far, the sort operation has been performed entirely in the computer's memory and no output file has been written. The sorting array is arranged such that the first element contains the record number of the record whose three categories come first in the alphabetical category list. NOTER.SORT reads that record from the input file and writes it as the first record in the output file. Reading a record from the input file and writing to the next position in the output file continues until the entire file has been written.

Sorting a Note Taker file can take awhile. A good deal of disk activity takes place, not to mention the actual sorting time. Remember that if something goes wrong, you only have to run the sort again. There is no chance that the sort program could destroy your input file. That is left for you to do when and if you wish.

Searching and Printing

Since it does little good to spend time typing information if you can't retrieve it, NOTER.SEARCH provides a convenient way of searching through Note Taker file categories and retrieving information. As an extra feature, NOTER.SEARCH can print notes as well.

NOTER.SEARCH uses a question-and-answer format. You ask a question, and NOTER.SEARCH searches through a Note Taker file to find the answer, if possible. You can display or

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print the notes it finds, then ask another question. The program continues this way until you have no more questions.

When you start up NOTER.SEARCH, you must let it know the name of the file you want to search. Then you'll be asked if your printer is ready. If you don't have a printer or if you simply don't wish to print during this session, respond that the printer is not ready.

NOTER.SEARCH will begin the question-and-answer session. All searches look for information in the three categories. You cannot do a search for words or phrases located in the five lines of text. The question screen is illustrated below.

CATEGORY 1:

CATEGORY 2:

CATEGORY 3:

ENTER SEARCH VALUES FOR EACH CATEGORY

TYPE 'STOP' IN CATEGORY 1 TO QUIT.

SEARCHING THE FILE. PLEASE WAIT.

EXAMINING RECORD 10

5 RECORDS MATCH SPECIFIED CATEGORIES.

PRESS ANY KEY TO VIEW THE RECORDS.

Type in the category information for which you are searching. NOTER.SEARCH will begin reading the file and will keep you informed of its progress. When the search is finished, press any key to display the selected records. If no records were found, you can ask another question. When you're finished, type STOP for Category 1. The program will return control to Applesoft.

You can do some interesting things when you type in the categories for a search. At first glance, it may seem that you have to type in all three categories. You may, and this will let you locate one specific entry. However, you may choose not to make an entry in a category—just press Return instead. This instructs NOTER.SEARCH to skip over the search on that category.

Let's review the medical records example. The three categories are

Category 1: Family member

Category 2: Name of illness

Category 3: Date of illness

Now, suppose you want to see Dad's medical records. Type

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DAD for Category 1. Press Return for Categories 2 and 3. Any note record where Category 1 is DAD will be retrieved. If you type FLU for Category 2 and Return for Categories 1 and 3, this would select all family members who had flu during the recording period.

Experiment with other combinations. For example, typing MOM for Category 1, Return for Category 2, and 85/02 for Category 3, will reveal Mom's complete medical history for February 1985, assuming dates were entered as year/month rather than as year/month/date.

One trick that may come in handy is to press Return for all three categories. NOTER.SEARCH will then retrieve all records in the file.

NOTER.SEARCH looks for an exact match between what you type in as a category and the information on file. As a good rule of thumb, keep the categories fairly general when you enter them. Then you won't have too much trouble remembering them in the future.

Once records have been retrieved, you can display them. The display screen is similar to the other Note Taker display screens:

CATEGORY 1:
CATEGORY 2:
CATEGORY 3:

1
2
3
4
5

RECORD 1 OF 50

PRESS:

BACK FORWARD PRINT PAGE/ALL QUIT

Pressing B or F will let you page backward or forward, one at a time, through the selected notes. Pressing Q will take you out of the display mode and return you to the point where you can ask another question.

To print, press P or A at the prompt. The P command prints one record—the record currently displayed on the screen. The A command, on the other hand, prints all selected records even though you can see only one record on the screen. For example, if 10 records of 50 were selected, A

would print all 10 of the selected records. The printed report is similar to the display screen. Record numbers also appear on the printed report to help you locate records to change later.

Expanding a Note Taker File

Eventually, you will fill up a Note Taker file. Don't panic—NOTER.EXPAND will fix the file for you. It will expand a Note Taker file to its maximum of 500 records.

Warning: In no circumstance should you run NOTER.SETUP to try to expand a Note Taker file. If you do, then it is time to panic. *This will destroy all of your data.*

Before you run NOTER.EXPAND, make sure you have enough disk space for the additional records. NOTER.EXPAND adds room at the end of the file. So you need space only for the new records.

NOTER.EXPAND will ask you for a filename. Assuming the Note Taker file can be located, NOTER.EXPAND will tell you the maximum number of records that the file can hold and the number of records currently in the file.

Next, NOTER.EXPAND will ask how many more notes you want the file to store. Enter the number, remembering the maximum restriction of 500 notes.

The file will be expanded by adding blank records to the end. NOTER.EXPAND will display an error message if it runs out of disk space. In this case, the file will have been expanded, but by less than the amount you asked for. You can go ahead and use the expanded file with any of the Note Taker programs. In particular, NOTER.ADD will let you enter additional data into the blank notes.

Program 5-3. NOTER.SETUP

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
BE 100 REM INITIALIZE NEW NOTE FILE (NOTER.SETUP)
BA 110 REM
B3 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
B4 130 MR = 500: REM MAX RECS
BC 140 RN = 0: REM REC #
BE 150 CF$ = "NOTEFILE"
B2 160 GOSUB 1350: REM TITLE SCREEN
B4 170 GOSUB 270: REM PAINT SCREEN
B1 180 IF Q$ = "Y" THEN 230
AC 190 GOSUB 400: REM GET FILE NAME
C2 200 IF Q$ = "Y" THEN 230
```

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```
BE 210 GOSUB 620: REM GET # NOTES
F2 220 GOSUB 740: REM INIT FILE
09 230 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C6 240 PRINT : PRINT : PRINT
94 250 END
8F 260 REM
B9 270 REM PAINT SCREEN
93 280 REM
57 290 HOME
1B 300 Q$ = "N"
31 310 VTAB 1: HTAB 1: PRINT "** INITIALIZE A NEW NO
TE FILE **"
F0 320 VTAB 4: HTAB 1: PRINT "THIS PROGRAM PREPARES
A NEW NOTE FILE."
DD 330 VTAB 6: HTAB 1: PRINT "ANY DATA ALREADY IN TH
E NOTE FILE WILL
46 340 VTAB 8: HTAB 1: PRINT "BE DESTROYED."
57 350 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY TO CONT
INUE OR"
0F 360 VTAB 14: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
."
70 370 GET R$: IF R$ = "" THEN 370
C2 380 IF ASC (R$) = 27 THEN Q$ = "Y"
25 390 RETURN
9D 400 REM GET FILE NAME
49 410 HOME
B1 420 VTAB 1: HTAB 1: PRINT "** INITIALIZE A NEW NO
TE FILE **"
BD 430 VTAB 4: HTAB 1: PRINT "TYPE IN THE NAME OF TH
E NEW FILE."
5A 440 TM$ = CF$
9D 450 RW = 6:CL = 1:SZ = 39: GOSUB 1000: REM SCREEN
READ
1B 460 IF TM$ < > "" THEN CF$ = TM$
DF 470 FL$ = CF$
FA 480 VTAB 8: HTAB 1: PRINT SPC( 40)
F2 490 VTAB 10: HTAB 1: PRINT SPC( 40)
F3 500 ONERR GOTO 580
CA 510 PRINT D$;"VERIFY ";FL$
3C 520 VTAB 8: HTAB 1: PRINT "THE FILE ALREADY EXIST
S."
7D 530 VTAB 10: HTAB 1: PRINT "DO YOU WANT TO DESTRO
Y IT (Y/N)? ";
CC 540 GOSUB 1280: REM GET Y OR N
DC 550 IF R$ = "N" THEN 450
16 560 PRINT D$;"DELETE ";FL$
23 570 RETURN
DD 580 POKE 216,0: REM NORMAL ERROR
A2 590 CALL - 3288: REM FIX STACK
98 600 GOTO 570
```

PERSONAL RECORD KEEPING

```
18 610 RETURN
09 620 REM HOW MANY RECORDS
80 630 REM
F4 640 VTAB 8: HTAB 1: PRINT SPC( 40)
EC 650 VTAB 10: HTAB 1: PRINT SPC( 40)
CC 660 VTAB 12: HTAB 1: PRINT "RESERVE SPACE FOR NOT
E RECORDS."
0F 670 VTAB 14: HTAB 1: PRINT "HOW MANY NOTE RECORDS
?"
20 680 VTAB 16: HTAB 1: PRINT "(MAX IS ";MR;")"
6E 690 TM$ = "25"
CB 700 RW = 14:CL = 25:SZ = 4: GOSUB 1000: REM SCREE
N READ"
14 710 IF TM$ = "" THEN 700
9A 720 RN = VAL (TM$): IF RN < 1 OR RN > MR THEN 700
1D 730 RETURN
CC 740 REM INIT FILE
92 750 REM
65 760 VTAB 18: HTAB 1: PRINT "INITIALIZING THE FILE
PLEASE WAIT."
0C 770 PRINT D$;"OPEN ";FL$;","L250"
36 780 ONERR GOTO 880
E9 790 FOR I = 0 TO RN
FC 800 PRINT D$;"WRITE ";FL$;","R"; STR$ (I)
D4 810 IF I = 0 THEN PRINT RN: PRINT 1
63 820 IF I < > 0 THEN PRINT SPC( 249)
06 830 NEXT
C0 840 PRINT D$;"CLOSE"
04 850 VTAB 20: HTAB 1: PRINT "FILE SUCCESSFULLY INI
TIALIZED."
07 860 FOR I = 1 TO 2000: NEXT
26 870 RETURN
78 880 REM I/O ERROR
E2 890 POKE 216,0: REM NORMAL ERROR
94 900 CALL - 3288: REM FIX STACK
30 910 INVERSE
49 920 VTAB 20: HTAB 1: PRINT "** ERROR DURING INITI
ALIZATION **"
D2 930 NORMAL
FE 940 VTAB 21: HTAB 1: PRINT "MAKE SURE THERE'S ENO
UGH DISK SPACE."
11 950 VTAB 22: HTAB 1: PRINT "FILE NOT INITIALIZED.
TRY AGAIN."
20 960 FOR I = 1 TO 5000: NEXT
C7 970 PRINT D$;"CLOSE"
A8 980 PRINT D$;"DELETE "FL$
28 990 RETURN
44 1000 REM -- LINE INPUT WITH TEMPLATE DRIVER
84 1010 GOSUB 1060: REM LINE INPUT
28 1020 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
```


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```
AF 1030 IF R$ < > "" THEN TM$ = R$
3F 1040 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
    (13);
E5 1050 RETURN
EE 1060 REM -- LINE INPUT SUBROUTINE
6F 1070 LET ZT$ = TM$:R$ = "":ZP = 0
7C 1080 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
F1 1090 VTAB RW: HTAB CL
84 1100 INVERSE : PRINT ZT$;: HTAB CL
46 1110 GET ZC$
C2 1120 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
C4 1130 IF ZC$ = CHR$ (24) THEN 1070: REM CTRL-X
23 1140 IF ZC$ = CHR$ (8) THEN 1200: REM LEFT ARROW
5F 1150 IF ZC$ = CHR$ (13) THEN 1250: REM CR
14 1160 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    1110
17 1170 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
C0 1180 LET ZP = ZP + 1: IF ZP > = SZ THEN 1250
76 1190 GOTO 1110
D1 1200 HTAB CL + ZP: PRINT " ";:ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
4C 1210 HTAB CL + ZP
17 1220 IF LEN (R$) < = 1 THEN R$ = ""
84 1230 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
    ) - 1)
64 1240 GOTO 1110
43 1250 NORMAL : REM CR
95 1260 PRINT CHR$ (13);
F1 1270 RETURN
AB 1280 REM -- GET Y OR N SUBROUTINE
4C 1290 GET R$: IF R$ = "" THEN 1290
5A 1300 IF R$ = "n" THEN R$ = "N"
3B 1310 IF R$ = "y" THEN R$ = "Y"
C2 1320 IF R$ < > "N" AND R$ < > "Y" THEN 1290
BB 1330 PRINT R$
E7 1340 RETURN
BE 1350 REM TITLE SCREEN
D2 1360 REM
5A 1370 HOME
22 1380 INVERSE
42 1390 FOR R = 3 TO 20
34 1400 VTAB R: HTAB 3: PRINT SPC( 35)
AD 1410 NEXT
49 1420 NORMAL
63 1430 VTAB 3: HTAB 16: PRINT SPC( 22)
68 1440 VTAB 4: HTAB 16: PRINT SPC( 22)
0F 1450 FOR R = 8 TO 17
BC 1460 VTAB R: HTAB 5: PRINT SPC( 31)
```


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```
C5 1470 NEXT
67 1480 VTAB 9: HTAB 10: PRINT "N O T E    T A K E R
   "
0A 1490 VTAB 14: HTAB 10: PRINT "MAKE A NEW NOTE FIL
   E"
46 1500 FOR R = 1 TO 4000: NEXT
DF 1510 RETURN
```

Program 5-4. NOTER.ADD

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
23 100 REM ADD NOTE FILE RECORDS (NOTER.ADD)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
DB 130 QQ$ = CHR$ (34): REM QUOTE MARK
9F 140 MR = 0: REM MAX RECORDS
82 150 NR = 0: REM NEXT AVAILABLE RECORD
68 160 NF$ = "NOTEFILE"
2C 170 GOSUB 1940: REM TITLE SCREEN
7C 180 GOSUB 290: REM INSTRUCTIONS
D5 190 IF Q$ = "Y" THEN 250
AC 200 GOSUB 390: REM GET FILE NAME
C6 210 IF Q$ = "Y" THEN 250
90 220 GOSUB 600: REM GET REC 0
D3 230 GOSUB 680: REM PAINT SCREEN
E4 240 GOSUB 870: REM ADD RECS
BC 250 PRINT D$;"CLOSE"
0F 260 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
CC 270 PRINT : PRINT : PRINT
9A 280 END
8E 290 REM INSTRUCTIONS
84 300 REM
0E 310 HOME :Q$ = "N"
44 320 VTAB 1: HTAB 1: PRINT "** ADD NEW NOTE FILE R
   ECORDS **"
D6 330 VTAB 4: HTAB 1: PRINT "ADD NEW RECORDS TO AN
   EXISTING FILE."
55 340 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY TO CONT
   INUE  OR"
0D 350 VTAB 14: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
   "
4E 360 GET R$: IF R$ = "" THEN 360
F1 370 IF R$ = CHR$ (27) THEN Q$ = "Y"
23 380 RETURN
AE 390 REM GET FILE NAME
85 400 REM
0F 410 HOME :Q$ = "N"
```

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```
45 420 VTAB 1: HTAB 1: PRINT "** ADD NEW NOTE FILE R
    ECORDS **"
62 430 VTAB 4: HTAB 1: PRINT "TYPE IN THE NOTE FILE
    NAME."
DF 440 TM$ = NF$
08 450 RW = 6:CL = 1:SZ = 39: GOSUB 1660: REM LINE I
    NPUT
D6 460 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
    : GOTO 540
28 470 IF TM$ < > "" THEN NF$ = TM$
67 480 FL$ = NF$
F2 490 VTAB 10: HTAB 1: PRINT SPC( 40)
E3 500 VTAB 12: HTAB 1: PRINT SPC( 40)
95 510 ONERR GOTO 550
CC 520 PRINT D$;"VERIFY ";FL$
D3 530 POKE 216,0: REM NORMAL ERROR
1D 540 RETURN
D7 550 POKE 216,0: REM NORMAL ERROR
9C 560 CALL - 3288: REM FIX STACK
CC 570 VTAB 10: HTAB 1: PRINT "THE FILE CANNOT BE FO
    UND."
8E 580 VTAB 12: HTAB 1: PRINT "TRY AGAIN OR TYPE '
    STOP'."
26 590 GOTO 440
EC 600 REM GET RECORD 0
89 610 REM
D1 620 PRINT D$;"OPEN ";FL$
D1 630 PRINT D$;"READ ";FL$;"R0"
8B 640 INPUT MR
8E 650 INPUT NR
FF 660 PRINT D$
24 670 RETURN
BF 680 REM PAINT SCREEN
99 690 REM
4A 700 HOME
2E 710 INVERSE
6F 720 VTAB 1: HTAB 1: PRINT SPC( 12)
B2 730 VTAB 2: HTAB 13: PRINT SPC( 28)
EF 740 VTAB 14: HTAB 1: PRINT SPC( 40)
FA 750 FOR R = 1 TO 14: VTAB R: HTAB 1: PRINT " ": N
    EXT
58 760 FOR R = 2 TO 14: VTAB R: HTAB 40: PRINT " ":
    NEXT
D8 770 NORMAL
5F 780 VTAB 4: HTAB 3: PRINT "CATEGORY 1:"
02 790 VTAB 5: HTAB 3: PRINT "CATEGORY 2:"
91 800 VTAB 6: HTAB 3: PRINT "CATEGORY 3:"
D2 810 I = 1: FOR R = 8 TO 12: VTAB R: HTAB 4: PRINT
    I:I = I + 1: NEXT
62 820 VTAB 16: HTAB 1: PRINT "TYPE 'STOP' IN CATEGO
    RY 1"
```

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```
66 830 VTAB 17: HTAB 1: PRINT "WHEN YOU ARE FINISHED  
  ."  
2E 840 VTAB 19: HTAB 1: PRINT "RECORD"  
FA 850 VTAB 19: HTAB 14: PRINT "OF"  
24 860 RETURN  
7C 870 REM ADD RECORDS  
99 880 REM  
94 890 GOSUB 1550: REM ERASE FIELDS  
80 900 GOSUB 950: REM GET ENTRY  
50 910 IF Q$ = "Y" THEN 940  
EF 920 GOSUB 1330: REM ADD ENTRY  
0F 930 IF Q$ < > "Y" THEN 890  
21 940 RETURN  
14 950 REM GET ENTRY  
96 960 REM  
05 970 PRINT D$  
D7 980 C1$ = "":C2$ = "":C3$ = "":L1$ = "":L2$ = "":  
  L3$ = "":L4$ = "":L5$ = ""  
4C 990 N1$ = RIGHT$ ("      " + STR$ (NR),5)  
B3 1000 N2$ = RIGHT$ ("      " + STR$ (MR),5)  
D0 1010 VTAB 19: HTAB 8: PRINT N1$  
B8 1020 VTAB 19: HTAB 17: PRINT N2$  
88 1030 GOSUB 1130: REM READ SCREEN  
C8 1040 IF Q$ = "Y" THEN 1120  
FF 1050 VTAB 21: HTAB 1: PRINT "OK TO ADD (Y/N)? ";  
3A 1060 GET R$: IF R$ = "" THEN 1060  
8D 1070 PRINT  
D2 1080 VTAB 21: HTAB 1: PRINT SPC( 39)  
28 1090 IF R$ = "N" OR R$ = "n" THEN 1030  
5C 1100 IF R$ = "Y" OR R$ = "y" THEN 1120  
64 1110 GOTO 1050  
D8 1120 RETURN  
E0 1130 REM READ SCREEN  
C6 1140 REM  
36 1150 TM$ = C1$:RW = 4:CL = 15:SZ = 24: GOSUB 1660  
  : REM CATEGORY 1  
95 1160 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"  
  : GOTO 1320  
7C 1170 C1$ = TM$: IF C1$ = "" THEN 1150  
C8 1180 TM$ = C2$:RW = 5:CL = 15:SZ = 24: GOSUB 1660  
  : REM CATEGORY 2  
1F 1190 C2$ = TM$  
31 1200 TM$ = C3$:RW = 6:CL = 15:SZ = 24: GOSUB 1660  
  : REM CATEGORY 3  
21 1210 C3$ = TM$  
F7 1220 TM$ = L1$:RW = 8:CL = 7:SZ = 30: GOSUB 1660:  
  REM LINE 1  
79 1230 L1$ = TM$  
A2 1240 TM$ = L2$:RW = 9:CL = 7:SZ = 30: GOSUB 1660:  
  REM LINE 2
```

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```
A1 1250 L2$ = TM$
AE 1260 TM$ = L3$:RW = 10:CL = 7:SZ = 30: GOSUB 1660
      : REM LINE 3
C9 1270 L3$ = TM$
F9 1280 TM$ = L4$:RW = 11:CL = 7:SZ = 30: GOSUB 1660
      : REM LINE 4
F1 1290 L4$ = TM$
IF 1300 TM$ = L5$:RW = 12:CL = 7:SZ = 30: GOSUB 1660
      : REM LINE 5
F3 1310 L5$ = TM$
DF 1320 RETURN
A1 1330 REM ADD ENTRY
CA 1340 REM
02 1350 IF NR > MR THEN 1510
B1 1360 PRINT D$;"WRITE ";FL$;","R"; STR$ (NR)
62 1370 PRINT QQ$;C1$;QQ$
A6 1380 PRINT QQ$;C2$;QQ$
EA 1390 PRINT QQ$;C3$;QQ$
69 1400 PRINT QQ$;L1$;QQ$
AD 1410 PRINT QQ$;L2$;QQ$
F1 1420 PRINT QQ$;L3$;QQ$
36 1430 PRINT QQ$;L4$;QQ$
7A 1440 PRINT QQ$;L5$;QQ$
86 1450 NR = NR + 1
17 1460 PRINT D$;"WRITE ";FL$;","R0"
7C 1470 PRINT MR
82 1480 PRINT NR
89 1490 PRINT D$
B2 1500 IF NR <= MR THEN 1540
BE 1510 VTAB 23: HTAB 1: PRINT "** THE FILE IS FULL
      **"
C9 1520 FOR I = 1 TO 4000: NEXT
03 1530 Q$ = "Y"
EB 1540 RETURN
73 1550 REM ERASE FIELDS
D6 1560 REM
06 1570 VTAB 4: HTAB 15: PRINT SPC( 24)
0B 1580 VTAB 5: HTAB 15: PRINT SPC( 24)
10 1590 VTAB 6: HTAB 15: PRINT SPC( 24)
13 1600 VTAB 8: HTAB 7: PRINT SPC( 32)
18 1610 VTAB 9: HTAB 7: PRINT SPC( 32)
8E 1620 VTAB 10: HTAB 7: PRINT SPC( 32)
94 1630 VTAB 11: HTAB 7: PRINT SPC( 32)
9A 1640 VTAB 12: HTAB 7: PRINT SPC( 32)
F1 1650 RETURN
6B 1660 REM -- LINE INPUT WITH TEMPLATE DRIVER
A4 1670 GOSUB 1720: REM LINE INPUT
4C 1680 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
03 1690 IF R$ < > "" THEN TM$ = R$
3D 1700 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
      (13);
```

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```
E3 1710 RETURN
EC 1720 REM -- LINE INPUT SUBROUTINE
6D 1730 LET ZT$ = TM$:R$ = "":ZP = 0
7A 1740 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
3C 1750 PRINT CHR$ (25): VTAB RW: HTAB CL: INVERSE :
    PRINT ZT$;
7B 1760 PRINT CHR$ (25): VTAB RW: HTAB CL
6A 1770 GET ZC$
E6 1780 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
6B 1790 IF ZC$ = CHR$ (24) THEN 1730: REM CTRL-X
A5 1800 IF ZC$ = CHR$ (8) THEN 1860: REM LEFT ARROW
DC 1810 IF ZC$ = CHR$ (13) THEN 1910: REM CR
96 1820 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    1770
15 1830 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
AE 1840 LET ZP = ZP + 1: IF ZP >= SZ THEN 1910
9B 1850 GOTO 1770
F5 1860 HTAB CL + ZP: PRINT " ":ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
D3 1870 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
3B 1880 IF LEN (R$) <= 1 THEN R$ = ""
DB 1890 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
    ) - 1)
86 1900 GOTO 1770
41 1910 NORMAL : REM CR
93 1920 PRINT CHR$ (13);
EF 1930 RETURN
C6 1940 REM TITLE SCREEN
DA 1950 REM
62 1960 HOME
2A 1970 INVERSE
4A 1980 FOR R = 3 TO 20
62 1990 VTAB R: HTAB 3: PRINT SPC( 35)
A2 2000 NEXT
3E 2010 NORMAL
5B 2020 VTAB 3: HTAB 16: PRINT SPC( 22)
5D 2030 VTAB 4: HTAB 16: PRINT SPC( 22)
04 2040 FOR R = 8 TO 17
B1 2050 VTAB R: HTAB 5: PRINT SPC( 31)
BA 2060 NEXT
5C 2070 VTAB 9: HTAB 10: PRINT "N O T E      T A K E R
    "
E5 2080 VTAB 14: HTAB 8: PRINT "ADD NEW NOTE FILE RE
    CORDS"
61 2090 FOR R = 1 TO 4000: NEXT
D4 2100 RETURN
```

PERSONAL RECORD KEEPING

Program 5-5. NOTER.CHANGE

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
E7 100 REM CHANGE NOTE FILE RECORDS (NOTER.CHANGE)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
E8 130 QQ$ = CHR$ (34): REM QUOTE
9F 140 MR = 0: REM MAX RECORDS
82 150 NR = 0: REM NEXT AVAILABLE RECORD
12 160 RP = 1: REM CURRENT RECORD POINTER
6A 170 NF$ = "NOTEFILE"
21 180 GOSUB 2620: REM TITLE SCREEN
6D 190 GOSUB 300: REM INSTRUCTIONS
C5 200 IF Q$ = "Y" THEN 260
9D 210 GOSUB 400: REM GET FILE NAME
C9 220 IF Q$ = "Y" THEN 260
94 230 GOSUB 610: REM GET REC 0
D7 240 GOSUB 690: REM PAINT SCREEN
8C 250 GOSUB 960: REM CHANGE RECS
BE 260 PRINT D$;"CLOSE"
11 270 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
CE 280 PRINT : PRINT : PRINT
9C 290 END
7D 300 REM INSTRUCTIONS
86 310 REM
10 320 HOME :Q$ = "N"
34 330 VTAB 1: HTAB 1: PRINT "** CHANGE NOTE FILE RE
CORDS **"
7A 340 VTAB 4: HTAB 1: PRINT "CHANGE NOTES ALREADY S
TORED ON FILE."
57 350 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY TO CONT
INUE OR"
8F 360 VTAB 14: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
."
70 370 GET R$: IF R$ = "" THEN 370
F3 380 IF R$ = CHR$ (27) THEN Q$ = "Y"
25 390 RETURN
9D 400 REM GET FILE NAME
87 410 REM
11 420 HOME :Q$ = "N"
35 430 VTAB 1: HTAB 1: PRINT "** CHANGE NOTE FILE RE
CORDS **"
64 440 VTAB 4: HTAB 1: PRINT "TYPE IN THE NOTE FILE
NAME."
E1 450 TM$ = NF$
FC 460 RW = 6:CL = 1:SZ = 39: GOSUB 2340: REM LINE I
NPUT
E8 470 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
: GOTO 550
```


PERSONAL RECORD KEEPING

```
2A 480 IF TM$ < > "" THEN NF$ = TM$
69 490 FL$ = NF$
E1 500 VTAB 10: HTAB 1: PRINT SPC( 40)
E5 510 VTAB 12: HTAB 1: PRINT SPC( 40)
B7 520 ONERR GOTO 560
CE 530 PRINT D$;"VERIFY ";FL$
D5 540 POKE 216,0: REM NORMAL ERROR
1F 550 RETURN
D9 560 POKE 216,0: REM NORMAL ERROR
9E 570 CALL - 3288: REM FIX STACK
CE 580 VTAB 10: HTAB 1: PRINT "THE FILE CANNOT BE FO
UND."
90 590 VTAB 12: HTAB 1: PRINT "TRY AGAIN OR TYPE '
STOP'."
16 600 GOTO 450
EE 610 REM GET RECORD 0
8B 620 REM
D3 630 PRINT D$;"OPEN ";FL$
D3 640 PRINT D$;"READ ";FL$;" ,R0"
8D 650 INPUT MR
90 660 INPUT NR
02 670 PRINT D$
26 680 RETURN
C1 690 REM PAINT SCREEN
88 700 REM
4C 710 HOME
30 720 INVERSE
71 730 VTAB 1: HTAB 1: PRINT SPC( 12)
B4 740 VTAB 2: HTAB 13: PRINT SPC( 28)
F1 750 VTAB 14: HTAB 1: PRINT SPC( 40)
FC 760 FOR R = 1 TO 14: VTAB R: HTAB 1: PRINT " ": N
EXT
5A 770 FOR R = 2 TO 14: VTAB R: HTAB 40: PRINT " ":
NEXT
DA 780 NORMAL
61 790 VTAB 4: HTAB 3: PRINT "CATEGORY 1:"
F0 800 VTAB 5: HTAB 3: PRINT "CATEGORY 2:"
93 810 VTAB 6: HTAB 3: PRINT "CATEGORY 3:"
D4 820 I = 1: FOR R = 8 TO 12: VTAB R: HTAB 4: PRINT
I:I = I + 1: NEXT
29 830 VTAB 16: HTAB 1: PRINT "RECORD"
F5 840 VTAB 16: HTAB 14: PRINT "OF"
F2 850 VTAB 18: HTAB 1: PRINT "PRESS:"
69 860 VTAB 19: HTAB 1: PRINT "BACK CHANGE ERASE FOR
WARD GET.# QUIT"
38 870 INVERSE
A1 880 VTAB 19: HTAB 1: PRINT "B"
25 890 VTAB 19: HTAB 6: PRINT "C"
03 900 VTAB 19: HTAB 13: PRINT "E"
88 910 VTAB 19: HTAB 19: PRINT "F"
```

PERSONAL RECORD KEEPING

```
4A 920 VTAB 19: HTAB 27: PRINT "G"
8F 930 VTAB 19: HTAB 33: PRINT "Q"
D4 940 NORMAL
23 950 RETURN
03 960 REM CHANGE RECORDS
98 970 REM
86 980 GOSUB 2230: REM ERASE FIELDS
9D 990 GOSUB 1040: REM GET AND DISPLAY CURRENT RECOR
D
8D 1000 IF Q$ = "Y" THEN 1030
12 1010 GOSUB 1340: REM INTERPRET COMMAND
B7 1020 IF Q$ < > "Y" THEN 980
DD 1030 RETURN
C5 1040 REM GET AND DISPLAY ENTRY
CB 1050 REM
2C 1060 N1$ = RIGHT$ (" " + STR$ (RP),5)
5D 1070 N2$ = RIGHT$ (" " + STR$ (NR - 1),5)
E6 1080 VTAB 16: HTAB 8: PRINT N1$
CE 1090 VTAB 16: HTAB 17: PRINT N2$
3E 1100 IF NR > 1 THEN 1150
7D 1110 VTAB 21: HTAB 1: PRINT "** THERE ARE NO NOTE
S ON FILE **"
10 1120 Q$ = "Y": FOR I = 1 TO 4000: NEXT
7C 1130 VTAB 21: HTAB 1: PRINT SPC( 40)
6E 1140 GOTO 1330
2B 1150 PRINT D$;"READ ";FL$;"R";RP
44 1160 INPUT C1$: REM CATEGORY 1
4D 1170 INPUT C2$: REM CATEGORY 2
56 1180 INPUT C3$: REM CATEGORY 3
B4 1190 INPUT L1$: REM LINE 1
A6 1200 INPUT L2$: REM LINE 2
BE 1210 INPUT L3$: REM LINE 3
D6 1220 INPUT L4$: REM LINE 4
EE 1230 INPUT L5$: REM LINE 5
A1 1240 PRINT D$
E8 1250 VTAB 4: HTAB 15: PRINT C1$
6E 1260 VTAB 5: HTAB 15: PRINT C2$
F3 1270 VTAB 6: HTAB 15: PRINT C3$
CA 1280 VTAB 8: HTAB 7: PRINT L1$
10 1290 VTAB 9: HTAB 7: PRINT L2$
C0 1300 VTAB 10: HTAB 7: PRINT L3$
47 1310 VTAB 11: HTAB 7: PRINT L4$
CD 1320 VTAB 12: HTAB 7: PRINT L5$
E3 1330 RETURN
87 1340 REM GET AND INTERPRET COMMAND
CE 1350 REM
3A 1360 VTAB 18: HTAB 8
85 1370 GET R$: IF R$ = "" THEN 1370
97 1380 PRINT
```

PERSONAL RECORD KEEPING

```
9F 1390 IF R$ = "B" OR R$ = "b" THEN GOSUB 1460: GOT
    O 1450
C3 1400 IF R$ = "C" OR R$ = "c" THEN GOSUB 1520: GOT
    O 1450
98 1410 IF R$ = "E" OR R$ = "e" THEN GOSUB 1630: GOT
    O 1450
E5 1420 IF R$ = "F" OR R$ = "f" THEN GOSUB 1750: GOT
    O 1450
AF 1430 IF R$ = "G" OR R$ = "g" THEN GOSUB 1800: GOT
    O 1450
E5 1440 IF R$ = "Q" OR R$ = "q" THEN Q$ = "Y"
ED 1450 RETURN
AE 1460 REM BACK
D8 1470 REM
96 1480 RP = RP - 1
56 1490 IF RP < 1 THEN RP = NR - 1
26 1500 IF RP < 1 THEN RP = 1
DF 1510 RETURN
CA 1520 REM CHANGE
CA 1530 REM
9E 1540 GOSUB 1900: REM READ SCREEN
92 1550 VTAB 21: HTAB 1: PRINT "OK TO CHANGE (Y/N)?
    ";
05 1560 GET R$: IF R$ = "" THEN 1560
97 1570 PRINT
98 1580 VTAB 21: HTAB 1: PRINT SPC( 40)
F5 1590 IF R$ = "Y" OR R$ = "y" THEN GOSUB 2100: GOT
    O 1620: REM UPDATE
18 1600 IF R$ = "N" OR R$ = "n" THEN 1620
78 1610 GOTO 1550
E5 1620 RETURN
83 1630 REM ERASE
D8 1640 REM
F4 1650 VTAB 21: HTAB 1: PRINT "OK TO ERASE NOTES (Y
    /N) ";
C7 1660 GET R$: IF R$ = "" THEN 1660
99 1670 PRINT
9A 1680 VTAB 21: HTAB 1: PRINT SPC( 40)
46 1690 IF R$ = "N" OR R$ = "n" THEN 1740
74 1700 IF R$ = "Y" OR R$ = "y" THEN 1720
7C 1710 GOTO 1650
45 1720 C1$ = "":C2$ = "":C3$ = "":L1$ = "":L2$ = "
    ":L3$ = "":L4$ = "":L5$ = ""
1E 1730 GOSUB 2100: REM UPDATE RECORD
EF 1740 RETURN
E2 1750 REM FORWARD
DA 1760 REM
94 1770 RP = RP + 1
8C 1780 IF RP > NR - 1 THEN RP = 1
#4 1790 RETURN
```

PERSONAL RECORD KEEPING

```
82 1800 REM GET RECORD #
C8 1810 REM
F5 1820 VTAB 18: HTAB 12: PRINT "WHAT RECORD?"
69 1830 TM$ = "":RW = 18:CL = 25:SZ = 6: GOSUB 2340:
    REM SCREEN READ
83 1840 IF TM$ = "" THEN 1830
7A 1850 T = VAL (TM$)
29 1860 IF T < 1 OR T > NR - 1 THEN 1820
A8 1870 RP = T
B1 1880 VTAB 18: HTAB 12: PRINT SPC( 28)
06 1890 RETURN
E4 1900 REM READ SCREEN
CA 1910 REM
06 1920 TM$ = C1$:RW = 4:CL = 15:SZ = 24: GOSUB 2340
    : REM CATEGORY 1
52 1930 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y
    ": GOTO 2090
84 1940 C1$ = TM$: IF C1$ = "" THEN 1920
98 1950 TM$ = C2$:RW = 5:CL = 15:SZ = 24: GOSUB 2340
    : REM CATEGORY 2
23 1960 C2$ = TM$
27 1970 TM$ = C3$:RW = 6:CL = 15:SZ = 24: GOSUB 2340
    : REM CATEGORY 3
48 1980 C3$ = TM$
08 1990 TM$ = L1$:RW = 8:CL = 7:SZ = 30: GOSUB 2340:
    REM LINE 1
6A 2000 L1$ = TM$
79 2010 TM$ = L2$:RW = 9:CL = 7:SZ = 30: GOSUB 2340:
    REM LINE 2
92 2020 L2$ = TM$
6B 2030 TM$ = L3$:RW = 10:CL = 7:SZ = 30: GOSUB 2340
    : REM LINE 3
BA 2040 L3$ = TM$
06 2050 TM$ = L4$:RW = 11:CL = 7:SZ = 30: GOSUB 2340
    : REM LINE 4
E2 2060 L4$ = TM$
02 2070 TM$ = L5$:RW = 12:CL = 7:SZ = 30: GOSUB 2340
    : REM LINE 5
0B 2080 L5$ = TM$
F6 2090 RETURN
F1 2100 REM CHANGE RECORD
BB 2110 REM
B1 2120 PRINT D$;"WRITE ";FL$;"R";RP
4F 2130 PRINT QQ$;C1$;QQ$
93 2140 PRINT QQ$;C2$;QQ$
D7 2150 PRINT QQ$;C3$;QQ$
7C 2160 PRINT QQ$;L1$;QQ$
C0 2170 PRINT QQ$;L2$;QQ$
05 2180 PRINT QQ$;L3$;QQ$
49 2190 PRINT QQ$;L4$;QQ$
```

PERSONAL RECORD KEEPING

```
67 2200 PRINT QQ$;L5$;QQ$
96 2210 PRINT D$
DE 2220 RETURN
66 2230 REM ERASE FIELDS
C9 2240 REM
F8 2250 VTAB 4: HTAB 15: PRINT SPC( 24)
FD 2260 VTAB 5: HTAB 15: PRINT SPC( 24)
03 2270 VTAB 6: HTAB 15: PRINT SPC( 24)
2C 2280 VTAB 8: HTAB 7: PRINT SPC( 32)
31 2290 VTAB 9: HTAB 7: PRINT SPC( 32)
81 2300 VTAB 10: HTAB 7: PRINT SPC( 32)
87 2310 VTAB 11: HTAB 7: PRINT SPC( 32)
8D 2320 VTAB 12: HTAB 7: PRINT SPC( 32)
E4 2330 RETURN
5B 2340 REM -- LINE INPUT WITH TEMPLATE DRIVER
7D 2350 GOSUB 2400: REM LINE INPUT
3F 2360 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
C6 2370 IF R$ < > "" THEN TM$ = R$
56 2380 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
    (13);
FC 2390 RETURN
DF 2400 REM -- LINE INPUT SUBROUTINE
60 2410 LET ZT$ = TM$:R$ = "":ZP = 0
6D 2420 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
2F 2430 PRINT CHR$ (25): VTAB RW: HTAB CL: INVERSE :
    PRINT ZT$;
6E 2440 PRINT CHR$ (25): VTAB RW: HTAB CL
5D 2450 GET ZC$
D9 2460 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
18 2470 IF ZC$ = CHR$ (24) THEN 2410: REM CTRL-X
1D 2480 IF ZC$ = CHR$ (8) THEN 2540: REM LEFT ARROW
3C 2490 IF ZC$ = CHR$ (13) THEN 2590: REM CR
E7 2500 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    2450
08 2510 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
6A 2520 LET ZP = ZP + 1: IF ZP > = SZ THEN 2590
7E 2530 GOTO 2450
E8 2540 HTAB CL + ZP: PRINT " ";:ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
C6 2550 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
2E 2560 IF LEN (R$) < = 1 THEN R$ = ""
CB 2570 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$)
    ) - 1)
92 2580 GOTO 2450
5A 2590 NORMAL : REM CR
86 2600 PRINT CHR$ (13);
E2 2610 RETURN
B9 2620 REM TITLE SCREEN
```

PERSONAL RECORD KEEPING

```

C0 2630 REM
55 2640 HOME
1D 2650 INVERSE
3D 2660 FOR R = 3 TO 20
55 2670 VTAB R: HTAB 3: PRINT SPC( 35)
CE 2680 NEXT
6A 2690 NORMAL
5E 2700 VTAB 3: HTAB 16: PRINT SPC( 22)
63 2710 VTAB 4: HTAB 16: PRINT SPC( 22)
0A 2720 FOR R = 8 TO 17
B7 2730 VTAB R: HTAB 5: PRINT SPC( 31)
C0 2740 NEXT
62 2750 VTAB 9: HTAB 10: PRINT "N O T E      T A K E R
      "
D9 2760 VTAB 14: HTAB 8: PRINT "CHANGE NOTE FILE REC
      ORDS"
67 2770 FOR R = 1 TO 4000: NEXT
01 2780 RETURN

```

Program 5-6. NOTER.SORT

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

42 100 REM SORT NOTE FILE RECORDS (NOTER.SORT)
04 110 REM
13 120 HOME : D$ = CHR$ (4): PRINT CHR$ (21)
9D 130 MR = 0: REM MAX RECORDS
00 140 NR = 0: REM NEXT AVAILABLE RECORD
C0 150 DIM RP$(500): REM RECORD NUMBERS
24 160 DIM K1$(500): REM CATEG 1
27 170 DIM K2$(500): REM CATEG 2
2A 180 DIM K3$(500): REM CATEG 3
6E 190 NF$ = "NOTEFILE"
97 200 SF$ = "NOTEFILE.SORTED"
1D 210 TL$ = "** SORT NOTE FILE RECORDS **"
07 220 REM
09 230 REM
14 240 GOSUB 2510: REM TITLE SCREEN
67 250 GOSUB 400: REM INSTRUCTIONS
52 260 IF Q$ = "Y" THEN 360
CA 270 GOSUB 520: REM GET SORT INPUT FILE NAME
56 280 IF Q$ = "Y" THEN 360
36 290 GOSUB 730: REM GET SORT OUTPUT FILE NAME
47 300 IF Q$ = "Y" THEN 360
3B 310 GOSUB 990: REM GET SORTIN REC 0
4B 320 IF Q$ = "Y" THEN 360
04 330 GOSUB 1110: REM INIT SORTOUT
4F 340 IF Q$ = "Y" THEN 360
49 350 GOSUB 1350: REM DO THE SORT

```


PERSONAL RECORD KEEPING

```
BF 360 PRINT D$;"CLOSE"
12 370 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
CF 380 PRINT : PRINT : PRINT
9D 390 END
7E 400 REM INSTRUCTIONS
87 410 REM
11 420 HOME :Q$ = "N"
24 430 VTAB 1: HTAB 1: PRINT TL$
FA 440 VTAB 4: HTAB 1: PRINT "SORT NOTES ACCORDING T
O CATEGORIES 1-3."
D7 450 VTAB 8: HTAB 1: PRINT "NOTE: THERE MUST BE EN
OUGH DISK SPACE"
2A 460 VTAB 10: HTAB 1: PRINT "FOR THE SORTED COPY O
F YOUR NOTE FILE."
60 470 VTAB 16: HTAB 1: PRINT "PRESS ANY KEY TO CONT
INUE OR"
18 480 VTAB 18: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
."
C5 490 GET R$: IF R$ = "" THEN 490
E5 500 IF R$ = CHR$ (27) THEN Q$ = "Y"
17 510 RETURN
B0 520 REM GET SORT INPUT FILE NAME
8C 530 REM
16 540 HOME :Q$ = "N"
29 550 VTAB 1: HTAB 1: PRINT TL$
FE 560 VTAB 4: HTAB 1: PRINT "TYPE IN NAME OF THE FI
LE TO SORT."
E6 570 TM$ = NF$
FB 580 RW = 6:CL = 1:SZ = 39: GOSUB 2230: REM LINE I
NPUT
F9 590 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
: GOTO 670
1C 600 IF TM$ < > "" THEN NF$ = TM$
5B 610 FL$ = NF$
E6 620 VTAB 10: HTAB 1: PRINT SPC( 40)
EA 630 VTAB 12: HTAB 1: PRINT SPC( 40)
0D 640 ONERR GOTO 680
D3 650 PRINT D$;"VERIFY ";FL$
DA 660 POKE 216,0: REM NORMAL ERROR
24 670 RETURN
DE 680 POKE 216,0: REM NORMAL ERROR
A3 690 CALL - 3288: REM FIX STACK
C0 700 VTAB 10: HTAB 1: PRINT "THE FILE CANNOT BE FO
UND."
82 710 VTAB 12: HTAB 1: PRINT "TRY AGAIN OR TYPE '
STOP'."
9D 720 GOTO 570
E7 730 REM GET NAME OF SORT OUTPUT FILE
90 740 REM
```

PERSONAL RECORD KEEPING

```
F8 750 VTAB 10: HTAB 1: PRINT "TYPE THE NAME OF THE
      SORTED OUTPUT FILE."
D5 760 VTAB 12: HTAB 1: PRINT "NAME MUST BE DIFFEREN
      T FROM INPUT FILE."
6B 770 TM$ = SF$
AF 780 RW = 14:CL = 1:SZ = 39: GOSUB 2230: REM LINE
      INPUT
F7 790 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
      : GOTO 950
23 800 IF TM$ < > "" THEN SF$ = TM$
DF 810 RF$ = SF$
C2 820 IF RF$ = FL$ THEN 750
F0 830 VTAB 16: HTAB 1: PRINT SPC( 40)
F4 840 VTAB 18: HTAB 1: PRINT SPC( 40)
01 850 ONERR GOTO 960
D7 860 PRINT D$;"VERIFY ";RF$
DE 870 POKE 216,0: REM NORMAL ERROR
93 880 VTAB 16: HTAB 1: PRINT "THE FILE ALREADY EXIS
      TS."
94 890 VTAB 18: HTAB 1: PRINT "DO YOU WANT TO DESTRO
      Y IT (Y/N)? ";
E7 900 GET R$: IF R$ = "" THEN 900
EA 910 PRINT
77 920 IF R$ = "N" OR R$ = "n" THEN 770
A4 930 IF R$ = "Y" OR R$ = "y" THEN 950
27 940 GOTO 890
23 950 RETURN
DD 960 POKE 216,0: REM NORMAL ERROR
A2 970 CALL - 3288: REM FIX STACK
AB 980 GOTO 950
27 990 REM GET REC 0 FROM SORTIN
B4 1000 REM
45 1010 PRINT D$;"OPEN ";FL$
45 1020 PRINT D$;"READ ";FL$;"",R0"
B8 1030 INPUT MR
BE 1040 INPUT NR
34 1050 PRINT D$;"CLOSE ";FL$
51 1060 IF NR > 2 THEN 1100
BA 1070 VTAB 20: HTAB 1: PRINT NR - 1;" RECORDS ON F
      ILE."
19 1080 VTAB 21: HTAB 1: PRINT "NO NEED TO SORT."
1A 1090 Q$ = "Y": FOR I = 1 TO 2000: NEXT
D3 1100 RETURN
51 1110 REM INITIALIZE SORT OUTPUT FILE
BE 1120 REM
04 1130 HOME : PRINT TL$
4A 1140 VTAB 4: HTAB 1: PRINT "INITIALIZING SORT OUT
      PUT FILE."
05 1150 VTAB 6: HTAB 1: PRINT "PLEASE WAIT ..."
B9 1160 PRINT D$;"OPEN ";RF$;"",L250"
```

PERSONAL RECORD KEEPING

```
DF 1170 ONERR GOTO 1270
A5 1180 FOR I = 0 TO MR
77 1190 PRINT D$;"WRITE ";RF$;"R";I
62 1200 IF I = 0 THEN PRINT MR: PRINT NR
68 1210 IF I < > 0 THEN PRINT SPC( 249)
AD 1220 NEXT
30 1230 PRINT D$;"CLOSE ";RF$
57 1240 POKE 216,0: REM NORMAL ERROR
C6 1250 VTAB 6: HTAB 1: PRINT "SORT OUTPUT SUCCESSFUL
    LY INITIALIZED."
ED 1260 RETURN
63 1270 POKE 216,0: REM NORMAL ERROR
EC 1280 CALL - 3288: REM FIX STACK
48 1290 PRINT D$;"CLOSE ";RF$
73 1300 VTAB 10: HTAB 1: PRINT "*** ERROR ***"
B2 1310 VTAB 12: HTAB 1: PRINT "UNABLE TO INITIALIZE
    OUTPUT FILE."
A0 1320 VTAB 14: HTAB 1: PRINT "MAKE SURE THERE'S EN
    OUGH DISK SPACE."
CD 1330 PRINT D$;"DELETE ";RF$
73 1340 Q$ = "Y": GOTO 1260
25 1350 REM SORT MAIN ROUTINE
D2 1360 REM
53 1370 GOSUB 1410: REM SORT INPUT PHASE
99 1380 GOSUB 1540: REM SORT PHASE
C9 1390 GOSUB 1800: REM SORT OUTPUT PHASE
D9 1400 RETURN
0D 1410 REM SORT INPUT PHASE
C4 1420 REM
0A 1430 HOME : PRINT TL$
05 1440 VTAB 4: HTAB 1: PRINT "SORT INPUT PHASE"
F3 1450 VTAB 6: HTAB 5: PRINT "READING INPUT FILE ..
    "
BF 1460 PRINT D$;"OPEN ";FL$;"",L250"
FD 1470 FOR I = 1 TO NR - 1
7E 1480 RR = I: GOSUB 1950: REM GET RECORD RR
39 1490 K1$(I) = C1$:K2$(I) = C2$:K3$(I) = C3$:RP%(I
    ) = I
AB 1500 NEXT
2E 1510 PRINT D$;"CLOSE ";FL$
0E 1520 VTAB 6: HTAB 5: PRINT "INPUT FILE SUCCESSFUL
    LY READ"
E7 1530 RETURN
A4 1540 REM SORT PHASE
D2 1550 REM
49 1560 VTAB 10: HTAB 1: PRINT "SORT PHASE"
3D 1570 VTAB 12: HTAB 5: PRINT "SORTING. PLEASE WAIT
    "
BD 1580 BL$ = "": FOR I = 1 TO 24:BL$ = BL$ + " ": N
    EXT
```

PERSONAL RECORD KEEPING

```

30 1590 LM = NR - 1:P1 = 1
20 1600 P1 = P1 * 2: IF P1 < = LM THEN 1600
37 1610 P1 = INT (P1 / 2)
63 1620 IF LM - P1 = 0 THEN 1610
48 1630 IF P1 = 0 THEN 1790
76 1640 FOR I = 1 TO LM - P1
33 1650 P2 = I
85 1660 P3 = P2 + P1
AB 1670 T1$ = LEFT$ (K1$(P2) + BL$,24) + LEFT$ (K2$(
    P2) + BL$,24) + LEFT$ (K3$(P2) + BL$,24)
5A 1680 T2$ = LEFT$ (K1$(P3) + BL$,24) + LEFT$ (K2$(
    P3) + BL$,24) + LEFT$ (K3$(P3) + BL$,24)
8D 1690 IF T1$ < = T2$ THEN 1760
CF 1700 T$ = K1$(P2):K1$(P2) = K1$(P3):K1$(P3) = T$
D7 1710 T$ = K2$(P2):K2$(P2) = K2$(P3):K2$(P3) = T$
DF 1720 T$ = K3$(P2):K3$(P2) = K3$(P3):K3$(P3) = T$
8F 1730 T% = RP$(P2):RP$(P2) = RP$(P3):RP$(P3) = T%
93 1740 P2 = P2 - P1
50 1750 IF P2 > 0 THEN 1660
C7 1760 NEXT
84 1770 GOTO 1610
B5 1780 VTAB 12: HTAB 5: PRINT "SORT SUCCESSFULLY CO
    MPLETED."
04 1790 RETURN
AA 1800 REM SORT OUTPUT PHASE
C8 1810 REM
7D 1820 QQ$ = CHR$ (34): REM QUOTE
65 1830 VTAB 16: HTAB 1: PRINT "SORT OUTPUT PHASE"
71 1840 VTAB 18: HTAB 5: PRINT "WRITING THE OUTPUT F
    ILE ..."
C3 1850 PRINT D$;"OPEN ";FL$;",L250"
C7 1860 PRINT D$;"OPEN ";RF$;",L250"
06 1870 FOR I = 1 TO NR - 1
93 1880 RR = RP$(I)
79 1890 GOSUB 1950: REM READ RECORD RR
49 1900 RR = I
88 1910 GOSUB 2090: REM WRITE RECORD RR
88 1920 NEXT
77 1930 VTAB 18: HTAB 5: PRINT "OUTPUT FILE SUCCESSF
    ULLY WRITTEN."
F3 1940 RETURN
23 1950 REM RANDOM READ RECORD RR
DE 1960 REM
83 1970 PRINT D$;"READ ";FL$;",R";RR
5C 1980 INPUT C1$: REM CATEGORY 1
65 1990 INPUT C2$: REM CATEGORY 2
35 2000 INPUT C3$: REM CATEGORY 3
93 2010 INPUT L1$: REM LINE 1
AB 2020 INPUT L2$: REM LINE 2
C3 2030 INPUT L3$: REM LINE 3

```

PERSONAL RECORD KEEPING

```

DB 2040 INPUT L4$: REM LINE 4
F3 2050 INPUT L5$: REM LINE 5
A2 2060 VTAB 20: HTAB 1
AA 2070 PRINT D$
F2 2080 RETURN
45 2090 REM RANDOM WRITE RECORD RR
B7 2100 REM
2E 2110 PRINT D$;"WRITE ";RF$;"R";RR
4B 2120 PRINT QQ$;C1$;QQ$
8F 2130 PRINT QQ$;C2$;QQ$
D3 2140 PRINT QQ$;C3$;QQ$
7B 2150 PRINT QQ$;L1$;QQ$
BC 2160 PRINT QQ$;L2$;QQ$
81 2170 PRINT QQ$;L3$;QQ$
45 2180 PRINT QQ$;L4$;QQ$
89 2190 PRINT QQ$;L5$;QQ$
8E 2200 VTAB 20: HTAB 1
96 2210 PRINT D$
DE 2220 RETURN
55 2230 REM -- LINE INPUT WITH TEMPLATE DRIVER
B7 2240 GOSUB 2290: REM LINE INPUT
39 2250 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$(13);
C0 2260 IF R$ < > "" THEN TM$ = R$
50 2270 VTAB RW: HTAB CL: PRINT LEFT$(TM$,SZ); CHR$(13);
F6 2280 RETURN
FF 2290 REM -- LINE INPUT SUBROUTINE
5A 2300 LET ZT$ = TM$:R$ = "":ZP = 0
67 2310 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$ = LEFT$(ZT$,SZ)
29 2320 PRINT CHR$(25): VTAB RW: HTAB CL: INVERSE : PRINT ZT$;
68 2330 PRINT CHR$(25): VTAB RW: HTAB CL
57 2340 GET ZC$
D3 2350 IF ZC$ = CHR$(3) THEN STOP : REM CTRL-C
90 2360 IF ZC$ = CHR$(24) THEN 2300: REM CTRL-X
56 2370 IF ZC$ = CHR$(8) THEN 2430: REM LEFT ARROW
B4 2380 IF ZC$ = CHR$(13) THEN 2480: REM CR
47 2390 IF ZC$ < CHR$(32) OR ZC$ > CHR$(127) THEN 2340
02 2400 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$ = R$ + ZC$
34 2410 LET ZP = ZP + 1: IF ZP > = SZ THEN 2480
72 2420 GOTO 2340
E2 2430 HTAB CL + ZP: PRINT " ":ZP = ZP - 1: IF ZP < 0 THEN ZP = 0: REM BACKSPACE
C0 2440 PRINT CHR$(25): VTAB RW: HTAB CL + ZP
28 2450 IF LEN (R$) < = 1 THEN R$ = ""
C5 2460 IF LEN (R$) > 1 THEN R$ = LEFT$(R$, LEN (R$) - 1)

```

PERSONAL RECORD KEEPING

```
86 2470 GOTO 2340
54 2480 NORMAL : REM CR
A6 2490 PRINT CHR$ (13);
DC 2500 RETURN
B3 2510 REM TITLE SCREEN
C7 2520 REM
4F 2530 HOME
17 2540 INVERSE
37 2550 FOR R = 3 TO 20
4F 2560 VTAB R: HTAB 3: PRINT SPC( 35)
C8 2570 NEXT
64 2580 NORMAL
7E 2590 VTAB 3: HTAB 16: PRINT SPC( 22)
5D 2600 VTAB 4: HTAB 16: PRINT SPC( 22)
04 2610 FOR R = 8 TO 17
B1 2620 VTAB R: HTAB 5: PRINT SPC( 31)
BA 2630 NEXT
5C 2640 VTAB 9: HTAB 10: PRINT "N O T E      T A K E R
"
AB 2650 VTAB 14: HTAB 9: PRINT "SORT NOTE FILE RECOR
DS"
61 2660 FOR R = 1 TO 4000: NEXT
FA 2670 RETURN
```

Program 5-7. NOTER.SEARCH

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
7B 100 REM SEARCH AND PRINT NOTE FILE RECORDS (NOTER
.SEARCH)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
9D 130 MR = 0: REM MAX RECORDS
80 140 NR = 0: REM NEXT AVAILABLE RECORD
05 150 RR = 0: REM RECORD NUMBER
0F 160 PP = 0: REM COUNT OF RECORDS SELECTED
5C 170 FF$ = CHR$ (12): REM PRINTER FORM FEED
40 180 DIM NL(500): REM RECORDS MATCHING SEARCH CRIT
ERIA
6E 190 NF$ = "NOTEFILE"
1D 200 GOSUB 3170: REM TITLE SCREEN
60 210 GOSUB 310: REM INSTRUCTIONS
CA 220 IF Q$ = "Y" THEN 270
A5 230 GOSUB 420: REM GET FILE NAME
CE 240 IF Q$ = "Y" THEN 270
9B 250 GOSUB 720: REM GET REC 0
7B 260 GOSUB 1900: REM SEARCH NOTE FILE
C8 270 PRINT D$;"CLOSE"
13 280 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
```


PERSONAL RECORD KEEPING

```
D0 290 PRINT : PRINT : PRINT
8B 300 END
7F 310 REM INSTRUCTIONS
8B 320 REM
12 330 HOME :Q$ = "N"
5B 340 VTAB 1: HTAB 1: PRINT "** SEARCH NOTE FILE RE
CORDS **"
E9 350 VTAB 4: HTAB 1: PRINT "LOCATE NOTES BELONGING
TO A CATEGORY."
63 360 VTAB 6: HTAB 1: PRINT "DISPLAY OR PRINT SELEC
TED NOTES."
5B 370 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY TO CONT
INUE OR"
13 380 VTAB 14: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
"
B4 390 GET R$: IF R$ = "" THEN 390
E4 400 IF R$ = CHR$ (27) THEN Q$ = "Y"
16 410 RETURN
A1 420 REM GET FILE NAME
8B 430 REM
15 440 HOME :Q$ = "N"
5E 450 VTAB 1: HTAB 1: PRINT "** SEARCH NOTE FILE RE
CORDS **"
6B 460 VTAB 4: HTAB 1: PRINT "TYPE IN THE NOTE FILE
NAME."
E5 470 TM$ = NF$
1F 480 RW = 6:CL = 1:SZ = 39: GOSUB 2890: REM LINE I
NPUT
F0 490 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
: GOTO 660
1B 500 IF TM$ < > "" THEN NF$ = TM$
5A 510 FL$ = NF$
E5 520 VTAB 10: HTAB 1: PRINT SPC( 40)
E9 530 VTAB 12: HTAB 1: PRINT SPC( 40)
EB 540 ONERR GOTO 670
D2 550 PRINT D$;"VERIFY ";FL$
D9 560 POKE 216,0: REM NORMAL ERROR
27 570 VTAB 16: HTAB 1: PRINT "NOTES CAN BE PRINTED
IF YOU WISH."
4B 580 VTAB 18: HTAB 1: PRINT "IS YOUR PRINTER READY
(Y/N)? ";
D6 590 GET R$: IF R$ = "" THEN 590
A0 600 IF R$ = "N" OR R$ = "n" THEN PS$ = "N": GOTO
630
7F 610 IF R$ = "Y" OR R$ = "y" THEN PS$ = "Y": GOTO
630
9E 620 GOTO 590
8B 630 IF PS$ = "Y" THEN VTAB 20: HTAB 1: PRINT "NOT
ES CAN BE PRINTED."
```

PERSONAL RECORD KEEPING

```
A9 640 IF PS$ = "N" THEN VTAB 20: HTAB 1: PRINT "NOT
    ES CANNOT BE PRINTED."
#3 650 FOR I = 1 TO 2000: NEXT
22 660 RETURN
DC 670 POKE 216,0: REM NORMAL ERROR
A1 680 CALL - 3288: REM FIX STACK
D1 690 VTAB 10: HTAB 1: PRINT "THE FILE CANNOT BE FO
    UND."
80 700 VTAB 12: HTAB 1: PRINT "TRY AGAIN OR TYPE '
    STOP'."
1B 710 GOTO 470
F1 720 REM GET RECORD 0
8E 730 REM
D6 740 PRINT D$;"OPEN ";FL$
D6 750 PRINT D$;"READ ";FL$;" ,R0"
90 760 INPUT MR
93 770 INPUT NR
05 780 PRINT D$
29 790 RETURN
B1 800 REM PAINT SCREEN
8B 810 REM
4F 820 HOME
33 830 INVERSE
74 840 VTAB 1: HTAB 1: PRINT SPC( 12)
B7 850 VTAB 2: HTAB 13: PRINT SPC( 28)
F4 860 VTAB 14: HTAB 1: PRINT SPC( 40)
FF 870 FOR R = 1 TO 14: VTAB R: HTAB 1: PRINT " ": N
    EXT
5D 880 FOR R = 2 TO 14: VTAB R: HTAB 40: PRINT " ":
    NEXT
DD 890 NORMAL
51 900 VTAB 4: HTAB 3: PRINT "CATEGORY 1:"
F3 910 VTAB 5: HTAB 3: PRINT "CATEGORY 2:"
96 920 VTAB 6: HTAB 3: PRINT "CATEGORY 3:"
D7 930 I = 1: FOR R = 8 TO 12: VTAB R: HTAB 4: PRINT
    I:I = I + 1: NEXT
2C 940 VTAB 16: HTAB 1: PRINT "RECORD"
F8 950 VTAB 16: HTAB 14: PRINT "OF"
F5 960 VTAB 18: HTAB 1: PRINT "PRESS:"
A7 970 VTAB 19: HTAB 1: PRINT "BACK FORWARD PRINT
    PAGE/ALL QUIT"
3E 980 INVERSE
A4 990 VTAB 19: HTAB 1: PRINT "B"
C9 1000 VTAB 19: HTAB 7: PRINT "F"
34 1010 VTAB 19: HTAB 22: PRINT "P"
E8 1020 VTAB 19: HTAB 27: PRINT "A"
8D 1030 VTAB 19: HTAB 32: PRINT "Q"
49 1040 NORMAL
E5 1050 RETURN
26 1060 REM DISPLAY SELECTED RECORDS
```

PERSONAL RECORD KEEPING

```
D0 1070 REM
DA 1080 IF PP = 0 THEN 1170
D5 1090 GOSUB 800: REM PAINT DISPLAY SCREEN
C7 1100 NC = 0: REM COUNT OF NOTES PRINTED
F9 1110 I = 1: REM INDEX TO RECORD POINTER ARRAY
AE 1120 GOSUB 2640: REM ERASE FIELDS
E8 1130 GOSUB 1180: REM GET AND DISPLAY CURRENT RECO
    RD
E1 1140 IF Q$ = "Y" THEN 1170
2C 1150 GOSUB 1350: REM INTERPRET COMMAND
B8 1160 IF Q$ < > "Y" THEN 1120
EF 1170 RETURN
D7 1180 REM GET AND DISPLAY ENTRY
DA 1190 REM
64 1200 RR = NL(I): REM RECORD # OF NEXT SELECTED RE
    CORD
57 1210 GOSUB 2750: REM RANDOM READ RECORD RR
22 1220 N1$ = RIGHT$ ("      " + STR$ (RR),5)
51 1230 N2$ = RIGHT$ ("      " + STR$ (NR - 1),5)
DA 1240 VTAB 16: HTAB 8: PRINT N1$
C2 1250 VTAB 16: HTAB 17: PRINT N2$
EC 1260 VTAB 4: HTAB 15: PRINT C1$
72 1270 VTAB 5: HTAB 15: PRINT C2$
F7 1280 VTAB 6: HTAB 15: PRINT C3$
CE 1290 VTAB 8: HTAB 7: PRINT L1$
ED 1300 VTAB 9: HTAB 7: PRINT L2$
C4 1310 VTAB 10: HTAB 7: PRINT L3$
4B 1320 VTAB 11: HTAB 7: PRINT L4$
D1 1330 VTAB 12: HTAB 7: PRINT L5$
E7 1340 RETURN
8B 1350 REM GET AND INTERPRET COMMAND
D2 1360 REM
3E 1370 VTAB 18: HTAB 8
0A 1380 GET R$: IF R$ = "" THEN 1380
9B 1390 PRINT
7D 1400 IF R$ = "B" OR R$ = "b" THEN GOSUB 1460: GOT
    O 1450
5F 1410 IF R$ = "F" OR R$ = "f" THEN GOSUB 1510: GOT
    O 1450
B5 1420 IF R$ = "P" OR R$ = "p" THEN GOSUB 1550: GOT
    O 1450
FE 1430 IF R$ = "A" OR R$ = "a" THEN GOSUB 1600: GOT
    O 1450
E5 1440 IF R$ = "Q" OR R$ = "q" THEN Q$ = "Y"
ED 1450 RETURN
AE 1460 REM BACK
D8 1470 REM
D2 1480 I = I - 1
49 1490 IF I < 1 THEN I = PP
DB 1500 RETURN
```

PERSONAL RECORD KEEPING

```
CE 1510 REM FORWARD
BB 1520 I = I + 1
FD 1530 IF I > PP THEN I = 1
EB 1540 RETURN
E7 1550 REM PRINT THIS PAGE
D6 1560 REM
F1 1570 IF PS$ = "N" THEN 1590
4A 1580 GOSUB 1720: REM PRINT A RECORD
FF 1590 RETURN
A6 1600 REM PRINT ALL SELECTED NOTES
C4 1610 REM
A7 1620 IF PS$ = "N" THEN 1710
7C 1630 T = I: REM HOLD CURRENT POINTER
91 1640 FOR I = 1 TO PP
D0 1650 RR = NL(I): REM SELECTED RECORD #
9C 1660 GOSUB 2750: REM GET RECORD RR
6B 1670 GOSUB 1720: REM PRINT RECORD
CD 1680 NEXT
6D 1690 I = T: REM GET BACK OLD REC #
DC 1700 RR = I: GOSUB 2750: REM OLD RECORD
E3 1710 RETURN
95 1720 REM PRINT A NOTE
CE 1730 REM
4B 1740 PRINT D$;"PR#1"
96 1750 T$ = RIGHT$ ("          " + STR$ (RR),5)
CC 1760 PRINT "RECORD ";T$; SPC( 8);"CATEGORY 1: ";C
1$
3C 1770 PRINT SPC( 20);"CATEGORY 2: ";C2$
C4 1780 PRINT SPC( 20);"CATEGORY 3: ";C3$
A3 1790 PRINT
FB 1800 PRINT SPC( 20);"1. ";L1$
84 1810 PRINT SPC( 20);"2. ";L2$
0D 1820 PRINT SPC( 20);"3. ";L3$
95 1830 PRINT SPC( 20);"4. ";L4$
1E 1840 PRINT SPC( 20);"5. ";L5$
90 1850 PRINT : PRINT
A1 1860 NC = NC + 1
66 1870 IF NC >= 5 THEN NC = 0: PRINT FF$
5C 1880 PRINT D$;"PR#0"
06 1890 RETURN
65 1900 REM SEARCH NOTE FILE
CA 1910 REM
FB 1920 Q$ = "N"
B7 1930 GOSUB 2070: REM GET SEARCH CRITERIA
06 1940 IF Q$ = "Y" THEN 1980
D6 1950 GOSUB 2370: REM SEARCH FILE
0E 1960 IF Q$ = "Y" THEN 1980
AB 1970 GOSUB 1060: REM DISPLAY SELECTED RECORDS
6A 1980 HOME
```

PERSONAL RECORD KEEPING

```
9F 1990 VTAB 12: HTAB 1: PRINT "DO YOU WANT TO DO AN
    OTHER"
36 2000 VTAB 14: HTAB 1: PRINT "SEARCH (Y/N)? ";
C4 2010 GET R$: IF R$ = "" THEN 2010
7A 2020 PRINT
77 2030 IF R$ = "Y" OR R$ = "y" THEN 1920
22 2040 IF R$ = "N" OR R$ = "n" THEN 2060
64 2050 GOTO 2010
EA 2060 RETURN
AF 2070 REM GET SEARCH CRITERIA
D5 2080 REM
64 2090 GOSUB 2120: REM PAINT SCREEN
86 2100 GOSUB 2260: REM GET CRITERIA
D8 2110 RETURN
24 2120 REM PAINT CRITERIA SCREEN
C3 2130 REM
1A 2140 HOME : INVERSE
8F 2150 VTAB 1: HTAB 1: PRINT SPC( 40)
99 2160 VTAB 7: HTAB 1: PRINT SPC( 40)
ED 2170 FOR R = 1 TO 7: VTAB R: HTAB 1: PRINT " ": N
    EXT
4C 2180 FOR R = 1 TO 7: VTAB R: HTAB 40: PRINT " ":
    NEXT
60 2190 NORMAL
46 2200 VTAB 3: HTAB 3: PRINT "CATEGORY 1:"
8B 2210 VTAB 4: HTAB 3: PRINT "CATEGORY 2:"
D0 2220 VTAB 5: HTAB 3: PRINT "CATEGORY 3:"
4B 2230 VTAB 10: HTAB 1: PRINT "ENTER SEARCH VALUES
    FOR EACH CATEGORY."
2B 2240 VTAB 12: HTAB 1: PRINT "TYPE 'STOP' IN CATEG
    ORY 1 TO QUIT."
EA 2250 RETURN
AF 2260 REM GET SEARCH CRITERIA
D5 2270 REM
EE 2280 S1$ = "":S2$ = "":S3$ = ""
1D 2290 TM$ = S1$:RW = 3:CL = 15:SZ = 24: GOSUB 2890
    : REM CATEGORY 1
0B 2300 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y
    ": GOTO 2360
E4 2310 S1$ = TM$
89 2320 TM$ = S2$:RW = 4:CL = 15:SZ = 24: GOSUB 2890
    : REM CATEGORY 2
0D 2330 S2$ = TM$
1B 2340 TM$ = S3$:RW = 5:CL = 15:SZ = 24: GOSUB 2890
    : REM CATEGORY 3
35 2350 S3$ = TM$
F0 2360 RETURN
7B 2370 REM SEARCH FILE
D8 2380 REM
FB 2390 PP = 0: REM POINTER TO ARRAY NL
```

PERSONAL RECORD KEEPING

```
00 2400 IF NR > 2 THEN 2440
02 2410 VTAB 20: HTAB 1: PRINT "## THERE ARE NO NOTE
    S ON FILE ##"
66 2420 FOR I = 1 TO 4000: NEXT :Q$ = "Y"
78 2430 GOTO 2630
20 2440 VTAB 16: HTAB 1: PRINT "SEARCHING THE FILE.
    PLEASE WAIT."
CC 2450 FOR RR = 1 TO NR - 1
35 2460 M1 = 0:M2 = 0:M3 = 0
64 2470 GOSUB 2750: REM READ RECORD RR
1B 2480 VTAB 18: HTAB 1: PRINT "EXAMINING RECORD ";R
    R
00 2490 IF S1$ = "" THEN M1 = 1
4B 2500 IF S1$ < > "" AND S1$ = C1$ THEN M1 = 1
E4 2510 IF S2$ = "" THEN M2 = 1
06 2520 IF S2$ < > "" AND S2$ = C2$ THEN M2 = 1
6F 2530 IF S3$ = "" THEN M3 = 1
C0 2540 IF S3$ < > "" AND S3$ = C3$ THEN M3 = 1
9E 2550 MM = M1 + M2 + M3
64 2560 IF MM = 3 THEN PP = PP + 1:NL(PP) = RR: REM
    RECORD # OF MATCH
CB 2570 NEXT
A2 2580 VTAB 20: HTAB 1: PRINT PP;" RECORDS MATCH SP
    ECIFIED CATEGORIES."
E4 2590 IF PP = 0 THEN Q$ = "Y": FOR I = 1 TO 2000:
    NEXT : GOTO 2630
99 2600 VTAB 22: HTAB 1: PRINT "PRESS ANY KEY TO VIE
    W THE RECORDS."
52 2610 GET R$: IF R$ = "" THEN 2610
86 2620 PRINT
EA 2630 RETURN
72 2640 REM ERASE FIELDS
D5 2650 REM
05 2660 VTAB 4: HTAB 15: PRINT SPC( 24)
0A 2670 VTAB 5: HTAB 15: PRINT SPC( 24)
0F 2680 VTAB 6: HTAB 15: PRINT SPC( 24)
3B 2690 VTAB 8: HTAB 7: PRINT SPC( 32)
17 2700 VTAB 9: HTAB 7: PRINT SPC( 32)
8D 2710 VTAB 10: HTAB 7: PRINT SPC( 32)
93 2720 VTAB 11: HTAB 7: PRINT SPC( 32)
99 2730 VTAB 12: HTAB 7: PRINT SPC( 32)
FB 2740 RETURN
2E 2750 REM RANDOM READ RECORD # RR
DB 2760 REM
BA 2770 VTAB 23: HTAB 1
84 2780 PRINT D$;"READ ";FL$;"R";RR
5D 2790 INPUT C1$: REM CATEGORY 1
40 2800 INPUT C2$: REM CATEGORY 2
49 2810 INPUT C3$: REM CATEGORY 3
A7 2820 INPUT L1$: REM LINE 1
```


PERSONAL RECORD KEEPING

```
BF 2830 INPUT L2$: REM LINE 2
D7 2840 INPUT L3$: REM LINE 3
EF 2850 INPUT L4$: REM LINE 4
08 2860 INPUT L5$: REM LINE 5
BA 2870 PRINT D$
03 2880 RETURN
79 2890 REM -- LINE INPUT WITH TEMPLATE DRIVER
B1 2900 GOSUB 2950: REM LINE INPUT
37 2910 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$(13);
BE 2920 IF R$ < > "" THEN TM$ = R$
4E 2930 VTAB RW: HTAB CL: PRINT LEFT$(TM$,SZ); CHR$(13);
FA 2940 RETURN
FD 2950 REM -- LINE INPUT SUBROUTINE
7E 2960 LET ZT$ = TM$:R$ = "":ZP = 0
8B 2970 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$ = LEFT$(ZT$,SZ)
4D 2980 PRINT CHR$(25): VTAB RW: HTAB CL: INVERSE : PRINT ZT$;
8C 2990 PRINT CHR$(25): VTAB RW: HTAB CL
42 3000 GET ZC$
BE 3010 IF ZC$ = CHR$(3) THEN STOP : REM CTRL-C
84 3020 IF ZC$ = CHR$(24) THEN 2960: REM CTRL-X
63 3030 IF ZC$ = CHR$(8) THEN 3090: REM LEFT ARROW
5A 3040 IF ZC$ = CHR$(13) THEN 3140: REM CR
8F 3050 IF ZC$ < CHR$(32) OR ZC$ > CHR$(127) THEN 3000
13 3060 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$ = R$ + ZC$
9C 3070 LET ZP = ZP + 1: IF ZP > = SZ THEN 3140
6E 3080 GOTO 3000
F3 3090 HTAB CL + ZP: PRINT " ":ZP = ZP - 1: IF ZP < 0 THEN ZP = 0: REM BACKSPACE
AB 3100 PRINT CHR$(25): VTAB RW: HTAB CL + ZP
13 3110 IF LEN(R$) < = 1 THEN R$ = ""
80 3120 IF LEN(R$) > 1 THEN R$ = LEFT$(R$, LEN(R$) - 1)
5C 3130 GOTO 3000
3F 3140 NORMAL : REM CR
91 3150 PRINT CHR$(13);
ED 3160 RETURN
C4 3170 REM TITLE SCREEN
0B 3180 REM
60 3190 HOME
02 3200 INVERSE
22 3210 FOR R = 3 TO 20
3A 3220 VTAB R: HTAB 3: PRINT SPC( 35)
B3 3230 NEXT
4F 3240 NORMAL
69 3250 VTAB 3: HTAB 16: PRINT SPC( 22)
```

PERSONAL RECORD KEEPING

```
5E 3260 VTAB 4: HTAB 16: PRINT SPC( 22)
15 3270 FOR R = 8 TO 17
C2 3280 VTAB R: HTAB 5: PRINT SPC( 31)
C8 3290 NEXT
47 3300 VTAB 9: HTAB 10: PRINT "N O T E      T A K E R
"
E3 3310 VTAB 14: HTAB 8: PRINT "SEARCH NOTE FILE REC
ORDS"
4C 3320 FOR R = 1 TO 4000: NEXT
E5 3330 RETURN
```

Program 5-8. NOTER.EXPAND

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
7F 100 REM EXPAND NOTE FILE (NOTER.EXPAND)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
90 130 MR = 0: REM MAX RECORDS
80 140 NR = 0: REM NEXT AVAILABLE RECORD
66 150 NF$ = "NOTEFILE"
1A 160 TL$ = "*** EXPAND NOTE FILE **"
90 170 REM
92 180 REM
30 190 GOSUB 1370: REM TITLE SCREEN
5E 200 GOSUB 310: REM INSTRUCTIONS
C8 210 IF Q$ = "Y" THEN 270
56 220 GOSUB 430: REM GET NOTE FILE NAME
CC 230 IF Q$ = "Y" THEN 270
9C 240 GOSUB 640: REM GET REC 0
A1 250 GOSUB 720: REM GET NUMBER OF ADDITIONAL NOTES
00 260 GOSUB 850: REM EXPAND THE NOTE FILE
C0 270 PRINT D$;"CLOSE"
13 280 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
D0 290 PRINT : PRINT : PRINT
88 300 END
7F 310 REM INSTRUCTIONS
88 320 REM
12 330 HOME :Q$ = "N"
25 340 VTAB 1: HTAB 1: PRINT TL$
65 350 VTAB 4: HTAB 1: PRINT "EXPAND NOTE FILE TO AL
LOW MORE NOTES."
08 360 VTAB 8: HTAB 1: PRINT "NOTE: THERE MUST BE EN
OUGH DISK SPACE"
85 370 VTAB 10: HTAB 1: PRINT "FOR STORING THE ADDIT
IONAL NOTES."
61 380 VTAB 16: HTAB 1: PRINT "PRESS ANY KEY TO CONT
INUE OR"
```

PERSONAL RECORD KEEPING

```
19 390 VTAB 18: HTAB 1: PRINT "PRESS ESC TO QUIT NOW
."
92 400 GET R$: IF R$ = "" THEN 400
E6 410 IF R$ = CHR$ (27) THEN Q$ = "Y"
18 420 RETURN
A3 430 REM GET FILE NAME
8D 440 REM
17 450 HOME :Q$ = "N"
2A 460 VTAB 1: HTAB 1: PRINT TL$
9A 470 VTAB 4: HTAB 1: PRINT "TYPE IN NAME OF THE FI
LE TO EXPAND."
E7 480 TM$ = NF$
10 490 RW = 6:CL = 1:SZ = 39: GOSUB 1090: REM LINE I
NPUT
EB 500 IF TM$ = "STOP" OR TM$ = "stop" THEN Q$ = "Y"
: GOTO 580
1D 510 IF TM$ < > "" THEN NF$ = TM$
5C 520 FL$ = NF$
E7 530 VTAB 10: HTAB 1: PRINT SPC( 40)
EB 540 VTAB 12: HTAB 1: PRINT SPC( 40)
1E 550 ONERR GOTO 590
D4 560 PRINT D$;"VERIFY ";FL$
DB 570 POKE 216,0: REM NORMAL ERROR
25 580 RETURN
DF 590 POKE 216,0: REM NORMAL ERROR
91 600 CALL - 3288: REM FIX STACK
C1 610 VTAB 10: HTAB 1: PRINT "THE FILE CANNOT BE FO
UND."
B3 620 VTAB 12: HTAB 1: PRINT "TRY AGAIN OR TYPE '
STOP'."
1F 630 GOTO 480
1F 640 REM GET REC 0
91 650 REM
D9 660 PRINT D$;"OPEN ";FL$
D9 670 PRINT D$;"READ ";FL$;"",R0"
93 680 INPUT MR
96 690 INPUT NR
3E 700 PRINT D$;"CLOSE ";FL$
19 710 RETURN
1F 720 REM GET NUMBER OF ADDITIONAL NOTES
8E 730 REM
31 740 HOME : PRINT TL$
AF 750 VTAB 4: HTAB 1: PRINT "EXPANDING NOTE FILE:"
CE 760 VTAB 6: HTAB 1: PRINT FL$
AA 770 VTAB 10: HTAB 1: PRINT "THE FILE CAN HOLD ";M
R;" NOTES."
0B 780 VTAB 12: HTAB 1: PRINT "THE FILE NOW HAS ";NR
- 1;" NOTES."
6A 790 VTAB 16: HTAB 1: PRINT "HOW MANY ADDITIONAL N
OTES?"
```

PERSONAL RECORD KEEPING

```
53 800 VTAB 17: HTAB 1: PRINT "(MAX NUMBER OF NOTES
    IS 500.)"
D6 810 TM$ = "":RW = 16:CL = 28:SZ = 4: GOSUB 1090:
    REM LINE INPUT
98 820 IF TM$ = "" THEN 810
7D 830 NN = VAL (TM$): IF MR + NN > 500 THEN 810
20 840 RETURN
D4 850 REM EXPAND THE NOTE FILE
95 860 REM
17 870 IF NN = 0 THEN 1020
7B 880 VTAB 19: HTAB 1: PRINT "EXPANDING THE NOTE FI
    LE ..."
E1 890 PRINT D$;"OPEN ";FL$
CF 900 ONERR GOTO 1030
F9 910 FOR RR = MR + 1 TO MR + NN
C7 920 PRINT D$;"WRITE ";FL$;"R";RR
BD 930 PRINT SPC( 249)
B3 940 PRINT D$;"WRITE ";FL$;"R0"
D5 950 PRINT RR: PRINT NR
0D 960 NEXT
05 970 PRINT D$
37 980 VTAB 19: HTAB 1: PRINT "NOTE FILE SUCCESSFULL
    Y EXPANDED."
0E 990 FOR I = 1 TO 2000: NEXT
20 1000 PRINT D$;"CLOSE ";FL$
47 1010 POKE 216,0: REM NORMAL ERROR
D9 1020 RETURN
4F 1030 POKE 216,0: REM NORMAL ERROR
D8 1040 CALL - 3288: REM FIX STACK
FB 1050 VTAB 21: HTAB 1: PRINT "** AN ERROR OCCURRED
    WHILE EXPANDING **"
A7 1060 VTAB 22: HTAB 1: PRINT "MAKE SURE THERE'S EN
    OUGH DISK SPACE."
B3 1070 FOR I = 1 TO 2000: NEXT
6A 1080 GOTO 1000
6B 1090 REM -- LINE INPUT WITH TEMPLATE DRIVER
7E 1100 GOSUB 1150: REM LINE INPUT
26 1110 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$ (13);
AD 1120 IF R$ < > "" THEN TM$ = R$
3D 1130 VTAB RW: HTAB CL: PRINT LEFT$ (TM$,SZ); CHR$
    (13);
E3 1140 RETURN
EC 1150 REM -- LINE INPUT SUBROUTINE
6D 1160 LET ZT$ = TM$:R$ = "":ZP = 0
7A 1170 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$ (ZT$,SZ)
3C 1180 PRINT CHR$ (25): VTAB RW: HTAB CL: INVERSE :
    PRINT ZT$;
7B 1190 PRINT CHR$ (25): VTAB RW: HTAB CL
44 1200 GET ZC$
```

PERSONAL RECORD KEEPING

```
C0 1210 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
42 1220 IF ZC$ = CHR$ (24) THEN 1160: REM CTRL-X
A5 1230 IF ZC$ = CHR$ (8) THEN 1290: REM LEFT ARROW
DC 1240 IF ZC$ = CHR$ (13) THEN 1340: REM CR
D1 1250 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    1200
15 1260 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$
AE 1270 LET ZP = ZP + 1: IF ZP > = SZ THEN 1340
72 1280 GOTO 1200
F5 1290 HTAB CL + ZP: PRINT " ";:ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
AD 1300 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
15 1310 IF LEN (R$) < = 1 THEN R$ = ""
B2 1320 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$
    ) - 1)
60 1330 GOTO 1200
41 1340 NORMAL : REM CR
93 1350 PRINT CHR$ (13);
EF 1360 RETURN
C6 1370 REM TITLE SCREEN
DA 1380 REM
62 1390 HOME
04 1400 INVERSE
24 1410 FOR R = 3 TO 20
3C 1420 VTAB R: HTAB 3: PRINT SPC( 35)
B5 1430 NEXT
51 1440 NORMAL
6B 1450 VTAB 3: HTAB 16: PRINT SPC( 22)
70 1460 VTAB 4: HTAB 16: PRINT SPC( 22)
17 1470 FOR R = 8 TO 17
C4 1480 VTAB R: HTAB 5: PRINT SPC( 31)
CD 1490 NEXT
49 1500 VTAB 9: HTAB 10: PRINT "N O T E      T A K E R
    "
7F 1510 VTAB 14: HTAB 12: PRINT "EXPAND NOTE FILE"
4E 1520 FOR R = 1 TO 4000: NEXT
E7 1530 RETURN
```


CHAPTER 6

Basics for Business

6

Basics for Business

If you operate a small business, have investments which you would like to manage more effectively, or just want to make sure that the money you are setting aside is earning the best possible yield, the programs in this chapter can help you. Here's a quick look at what's ahead:

Quick Spread. This simple spreadsheet program that you can type in yourself is not as sophisticated as commercial spreadsheets, but it can handle many tasks. (See Programs 6-1 through 6-3.)

Tax Depreciation Schedule. If you own property or equipment that is depreciating, Program 6-4 can help you prepare depreciation schedules.

Future Worth. Questions about buying or leasing or return on investments often involve determining the future value of money. Program 6-5 assists with this type of analysis.

QUICK SPREAD

Spreadsheets are programs that manipulate rows and columns of numbers. They can be used for applications ranging from simple record keeping to sophisticated modeling and forecasting. Typical commercial programs can store large amounts of data with some packages capable of processing as many as 65,536 rows and 250 columns.

"Quick Spread" (made up of the three programs, QUICK.SPREAD, QUICK.FORMULA, and QUICK.PRINT) takes a more modest approach. It consists of 15 rows and four columns, for a total of 60 cells. If you have an Apple IIc or one of the newer *Enhanced* IIs, you can run Quick Spread in the 80-column mode which gives you 15 rows and eight columns. While this is not an enormous amount of room, it is ample for such applications as recording expenses for a quarter, tracking investment yields, and monitoring utility usage.

The intersection of a row and a column is termed a *cell*. Typically, a cell will contain a number. In QUICK.SPREAD (the main spreadsheet program), one of three things can be stored in a cell: a *value* (or *number*), a *label*, or a *formula*.

Actually, a formula and a value can occupy a cell at the same time. A formula gives the rules for calculating a result. When the result is determined, the number appears in the cell. A label is just a short description of the contents of a cell. Examples of labels are TOTAL and YIELD. *A number and a label cannot occupy a cell at the same time.*

QUICK.SPREAD assumes that all the numbers in the spreadsheet will represent dollars and cents. Specifically, numbers are displayed with up to five digits before the decimal point and two digits after the decimal point. The largest number that you can have is 99999.99, and the smallest number is -99999.99. Most budgets should fit within these limits.

QUICK.SPREAD uses a *manual calculation* mode. That is, the calculations are performed only when you ask for them. It's not the world's fastest calculator, so manual calculation lets you alter as many cells as you want without your having to wait for recalculation before going on to the next cell. The disadvantage is that *you have to remember to tell QUICK.SPREAD to calculate.*

For your convenience, QUICK.SPREAD provides a way to save spreadsheets on disk. Thus, at the end of the month you can read in the previous month's figures, update the spreadsheet with new figures, and then save the results for the next month.

All in all, QUICK.SPREAD has the features that you'll most likely need as you begin to use a spreadsheet as a home planning tool. At some point, you may outgrow QUICK.SPREAD and move up to a more sophisticated package.

Using the Electronic Spreadsheet

When QUICK.SPREAD starts up, it will ask if you want to load a spreadsheet file from disk. Respond by typing either Y or N in *uppercase*. If you want to read a file, QUICK.SPREAD will ask for its name; type in the filename and press Return. If the file can't be located, QUICK.SPREAD will ask you to try again.

When the file is located, all the labels, values, and formulas will be read from disk and placed in the spreadsheet. In other words, you can pick up where you left off with no retyping.

If you are a ProDOS user, QUICK.SPREAD will expect to find its files in the volume directory. Normally, this should cause no problems. Just remember that ProDOS can store only up to 51 files in its volume directory.

Next, QUICK.SPREAD goes into its spreadsheet mode. You will see a display similar to Figure 6-1. In the 40-column display mode, the four spreadsheet columns are labeled A, B, C, and D going across the screen. The 15 rows are numbered 1 through 15 and appear in the leftmost screen columns. The name of a cell is its column label followed by its row number. For example, the cell in the upper-left corner is called A1.

The last line of the screen displays the available commands. The first letter of each command is shown in inverse video. To execute a command, type its first letter.

Most commands are carried out on the *current cell* which is always displayed in inverse video. You can select any cell as the current cell with the cursor keys. These keys vary depending on which Apple you have:

Cursor Key	Apple II, II+	Apple IIe, IIc
Up	Control-E	Up arrow
Down	Control-X	Down arrow
Right	Control-D	Right arrow
Left	Control-S	Left arrow

As the cursor moves around, you'll notice that the name of the current cell and its contents (label, value, and formula) are displayed near the bottom of the screen.

Figure 6-1. Quick Spread Display

	A	B	C	D
1	99999.99			
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

CELL <A1 > ?:
VALUE: 99999.99
CALC ERASE FORMULA LABEL VALUE QUIT

Generally, you should select a desired cell and then type in an appropriate command. The commands *Erase*, *Formula*, *Label*, and *Value* apply only to cells. That is, these commands will in some way affect the current cell. The commands *Calculate* and *Quit* are independent of the current cell. They tell QUICK.SPREAD to do something to the entire spreadsheet.

Erase clears the contents of the current cell. Whatever is present—label, value, or formula—is removed.

Formula is the way to enter calculation rules (equations) into the spreadsheet. A formula computes a result based on the contents of other cells in the spreadsheet. The result of the calculation is stored in the cell containing the formula. The

rules governing formulas are discussed in a separate section.

Label places a title in the current cell. An example of a label is TOTAL. A label can be up to eight characters long and may contain letters, numbers, or punctuation symbols.

Value is similar, but it places a number into the current cell. A value can be up to nine characters long. This includes the sign, the decimal point, and five digits before and two after the decimal point. If you enter a number that is too big, you will see asterisks in the current cell. This is a signal to correct the problem.

After entering all the information into the spreadsheet, you'll want to calculate. Type C for Calculate, and let QUICK.SPREAD take over from there. QUICK.SPREAD starts with the first column and proceeds from row 1 through row 15, calculating and displaying the results. QUICK.SPREAD then continues with the rest of the columns. When it finds a formula, QUICK.SPREAD will display it near the bottom of the screen. You can actually watch the step-by-step calculations as they take place. An error in any formula causes QUICK.SPREAD to halt. Correct the error and calculate all over again.

Quit allows you to leave QUICK.SPREAD when you are finished. The program clears the screen and asks if you want to save the spreadsheet. If you type N, it will ask for verification. Remember that it is easier to erase extra files than it is to recreate lost ones.

That's it for the basic operation of the spreadsheet. All you have to do is move the cursor around and enter the information in the appropriate cells.

Formulas

A formula is a set of operands and operators. An operand may be either the name of a cell, such as A10 or B2, or a number, such as 1.10 or 25. QUICK.SPREAD understands the familiar arithmetic operators—add, subtract, multiply, and divide. Spaces may be freely used between operands and operators.

Formulas are evaluated from left to right. Multiplication and division are performed before addition and subtraction. For example, the formula

$10 + 2 * 6$

evaluates to 22. The multiplication, $2 * 6$, is performed first,

giving an intermediate result of 12. The addition, $10 + 12$, is then performed, yielding 22 as the result.

QUICK.SPREAD doesn't understand parentheses. Occasionally, you may have a complicated formula which requires the use of parentheses. The way to handle this situation in QUICK.SPREAD is to calculate an intermediate result and store it in an unused cell. Then you can reference the intermediate result in your formula.

If QUICK.SPREAD finds an error in a formula, it will stop calculating and display an error message. It will attempt to point out the place in the formula where the error occurred. Here is a list of error messages:

COLUMN OUTSIDE THE RANGE A..D (or A..H). The column portion of a cell name is incorrect. Columns range from A to D in the 40-column display mode and A to H in the 80-column display mode.

ROW OUTSIDE THE RANGE 1..15. The row part of a cell name is incorrect. Rows range in number from 1 to 15.

CELL HAS NO VALUE. The formula referenced a cell that does not have a value. Each cell in a formula must have a value. The value may either be entered or may be the result of a previous calculation.

ALPHA OR SPECIAL CHARACTER IN A NUMBER. The digits 0 through 9, plus and minus signs, and the decimal point are the only valid characters for a number. Some other character (like #, %, or \$) was found in a number.

CAN'T DIVIDE BY ZERO. An attempt was made to divide by zero. Perhaps there is an error in the formula, or perhaps the cell has an incorrect value.

Customizing the Program

You can make some alterations to QUICK.SPREAD to tailor it more closely to your needs. After you learn the basics of operating the spreadsheet, here are some features you can modify.

40- or 80-column mode. The Apple IIe and IIc are capable of displaying either 40 or 80 columns of text per line. QUICK.SPREAD can double the number of spreadsheet columns from 4 to 8 in the 80-column mode. If you want to use the larger spreadsheet, set the variable DW (display width) to 80 in line 160. *The 80-column mode will work properly on the*

IIC and on the Enhanced IIC. It may not work well on older IIC's due to problems with BASIC's HTAB command in the 80-column mode.

Display format. As long as you work within the limit of nine characters, including the sign and decimal point, you can alter the display format of the cells. Set the variables DB (digits before decimal point) and DA (Digits after decimal point) appropriately in line 230.

Cursor keys. You may use any keys that you like for controlling cursor movement. The subroutine in lines 4300–4320 assigns values to the string variables CU\$, CD\$, CL\$, and CR\$. These variables control up, down, left, and right movement, respectively. They are automatically set by the program according to the type of computer on which the program is running.

Editing keys. The line input subroutine uses Control-X to erase an entry, the left arrow to backspace over errors, and Control-C to halt the program. You may alter these key definitions in lines 4740–4760.

If you make any of these changes, don't forget to save a copy of the program (under a different name) with the changes in it.

Spreadsheet Example

Figure 6-2 is a sample spreadsheet application. It tracks expenses by category for a quarter. It can give you an indication of where your paycheck is being spent.

Figure 6-2 lists a few typical expense categories. These are entered as row labels. You can supply your own category names if you wish. Notice that the example uses only six categories. The columns are labeled according to the first three months of the year.

There are three formulas in this sample spreadsheet. These compute expense totals for January, February, and March. There is nothing complicated about the formulas—they just add up the six expense categories. Enter the formulas in the cells where you want the totals to appear.

Once you've set up the spreadsheet, try entering values and using the Calculate command. See if the totals come out correctly and appear in the proper cells. After experimenting with this simple example, you can develop more sophisticated spreadsheets of your own to manage your personal finances.

Figure 6-2. Sample Spreadsheet

	A	B	C	D
1	EXPENSE	JAN	FEB	MAR
2				
3	FOOD			
4	MORTGAGE			
5	ELECTRIC			
6	AUTO			
7	GIFTS			
8	MISC			
9				
10				
11				
12	TOTAL			
13				
14				
15				

Enter the following formulas:

Cell B12 $B3 + B4 + B5 + B6 + B7 + B8$

Cell C12 $C3 + C4 + C5 + C6 + C7 + C8$

Cell D12 $D3 + D4 + D5 + D6 + D7 + D8$

Printing Formulas

After you've developed a spreadsheet, you might want a printed record of the formulas and labels. *Of course, you must have a printer that will work with your computer.* Perhaps one particular spreadsheet will serve as the basis for others. It's convenient to develop the new spreadsheets by working from a printout.

QUICK.FORMULA will access a spreadsheet file produced by QUICK.SPREAD and print a report of the spreadsheet's formulas and labels. QUICK.FORMULA starts with column 1 and looks at each row within this column. If a formula is present in a cell, the formula is printed on the report along with the identifying row and column number. When finished with column 1, the program proceeds with column 2. Using the same approach, it produces a separate report showing the location of all labels in the spreadsheet.

Using QUICK.FORMULA is easy. The program will ask you for the name of a spreadsheet file, and if the file is not

present, QUICK.SPREAD will give you an opportunity to re-type the filename.

If it finds the file, QUICK.FORMULA will tell you it's ready to print the report. Press a key when prompted, and the program will begin printing the report. Note that you have an opportunity to cancel printing by pressing the Escape key.

Printing the Spreadsheet

When you finish a spreadsheet, with the calculations and labels correct, the values entered, and the results calculated, a printout of the final product is generally useful for your records. QUICK.PRINT will print spreadsheet reports for you easily and efficiently.

QUICK.PRINT operates much like QUICK.FORMULA. Specify the name of the spreadsheet file and let the program know when your printer is ready. QUICK.PRINT does the rest. It will read the spreadsheet file and print a report that closely resembles QUICK.SPREAD's screen display. The report will contain all labels and values as well as the row and column grid labels. *Formulas are not printed.*

Keep in mind that QUICK.PRINT's report is based on the contents of the specified spreadsheet *file* produced by QUICK.SPREAD. If you are working with the spreadsheet and are changing values and recalculating, don't forget to save the information to a spreadsheet file for each sheet you want to print.

Program 6-1. QUICK.SPREAD

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
31 100 REM ELECTRONIC SPREADSHEET (QUICK.SPREAD)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
98 130 REM
90 140 REM DW CONTROLS DISPLAY WIDTH. SET DW TO EITHER 40 OR 80
80 150 REM
C2 160 DW = 40
60 170 NR = 15:NC = INT (DW / 10): REM NUMBER ROWS AND COLUMNS
73 180 DIM SS$(NR,NC): REM SPREADSHEET
A2 190 DIM TP$(NR,NC): REM CELL TYPE
74 200 DIM CF$(NR,NC): REM CALCULATION FORMULA
B0 210 DIM S1(40),S2$(40): REM OPERAND AND OPERATOR STACKS
```

BASICS FOR BUSINESS

```
9C 220 CR = 1:CC = 1:BL$ = "           ": REM CURRENT
      ROW & COLUMN, BLANKS
6B 230 DB = 5:DA = 2: REM DIGITS BEFORE AND AFTER DE
      CIMAL
8B 240 REM
C1 250 REM INITIALIZATION SECTION
8F 260 REM
24 270 GOSUB 4340: REM TITLE SCREEN
3B 280 GOSUB 4200: REM INITIALIZE SS ARRAYS
0A 290 GOSUB 4280: REM SET CURSOR MOVEMENT VALUES
07 300 IF DW = 40 THEN PRINT CHR$ (21): REM 40 COLUM
      N MODE
52 310 IF DW = 80 THEN PRINT D$;"PR#3": REM 80 COLUM
      N MODE
8B 320 REM
2B 330 REM SEE IF THERE IS AN INPUT FILE
8C 340 REM
8D 350 GOSUB 540: REM CHECK INPUT
9B 360 REM
FB 370 REM SPREADSHEET OPERATION
94 380 REM
9F 390 GOSUB 3790: REM TEMPLATE
AF 400 GOSUB 1050: REM DISPLAY CELL CONTENTS AFTER L
      OAD
A6 410 GOSUB 2450: REM DISPLAY A1 TO START
A0 420 GOSUB 1520: REM OBTAIN AND INTERPRET COMMANDS
8B 430 REM
8F 440 REM SAVE IT?
8F 450 REM
05 460 GOSUB 1140: REM SAVE SS
93 470 REM
04 480 REM ALL DONE
97 490 REM
CC 500 PRINT CHR$ (21)
08 510 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C5 520 PRINT : PRINT : PRINT
93 530 END
66 540 REM CHECK FOR SS LOAD
9B 550 REM
54 560 HOME
F2 570 PRINT
C8 580 VTAB 6: HTAB 1: PRINT "DO YOU WANT TO LOAD A
      SPREADSHEET FILE?"
FD 590 VTAB 8: HTAB 1: PRINT "TYPE 'Y' OR 'N'. -> "
      ;
B4 600 GET R$: IF R$ = "" THEN 600
04 610 PRINT R$
A0 620 IF R$ < > "Y" AND R$ < > "N" THEN 580
5B 630 IF R$ = "N" THEN 720
```


BASICS FOR BUSINESS

```
10 640 VTAB 12: HTAB 1: PRINT "WHAT IS THE FILE NAME
?"
E2 650 RW = 14:CL = 1:SZ = DW - 1: GOSUB 4630: REM L
    INE INPUT
D2 660 IF A$ = "" THEN 650
B3 670 VTAB 16: HTAB 1: PRINT SPC( DW)
A4 680 ONERR GOTO 740
5D 690 PRINT D$;"VERIFY ";A$
63 700 POKE 216,0: REM DISABLE ONERR
5D 710 GOSUB 770: REM LOAD SPREADSHEET
4E 720 HOME
1D 730 RETURN
40 740 VTAB 16: HTAB 1: PRINT "THE FILE CANNOT BE LO
    CATED. TRY AGAIN."
9C 750 CALL - 3288: REM FIX STACK
23 760 GOTO 640
83 770 REM LOAD SPREADSHEET
98 780 REM
E4 790 VTAB 16: HTAB 1: PRINT "READING THE FILE. PL
    EASE WAIT."
30 800 PRINT D$;"OPEN ";A$
FA 810 PRINT D$;"READ ";A$
7D 820 INPUT R: REM NUMBER OF ROWS
09 830 INPUT C: REM NUMBER OF COLS
68 840 IF R < = NR AND C < = NC THEN 920
55 850 HOME
45 860 VTAB 12: HTAB 1: PRINT "CAN'T LOAD SPREADSHEE
    T."
7F 870 VTAB 14: HTAB 1: PRINT "SPREADSHEET CREATED I
    N 80 COLUMN MODE"
13 880 VTAB 16: HTAB 1: PRINT "ISN'T COMPATIBLE WITH
    40 COLUMN MODE."
D6 890 PRINT : PRINT : PRINT
B9 900 PRINT D$;"CLOSE"
F9 910 STOP
FC 920 FOR I = 1 TO R: FOR J = 1 TO C
37 930 INPUT T$
1E 940 IF T$ < > "" THEN SS$(I,J) = RIGHT$(BL$ + T$
    ,9)
A3 950 IF T$ = "" THEN SS$(I,J) = ""
CE 960 NEXT : NEXT
07 970 FOR I = 1 TO R: FOR J = 1 TO C
2B 980 INPUT TP$(I,J)
D4 990 NEXT : NEXT
91 1000 FOR I = 1 TO R: FOR J = 1 TO C
8F 1010 INPUT CF$(I,J)
2D 1020 NEXT : NEXT
AD 1030 PRINT D$;"CLOSE ";A$
E1 1040 RETURN
27 1050 REM DISPLAY CELLS
```


BASICS FOR BUSINESS

```
CC 1060 REM
97 1070 FOR I = 1 TO R
28 1080 FOR J = 1 TO C
AF 1090 IF SS$(I,J) = "" THEN 1110
DF 1100 VTAB I + 2: HTAB (J - 1) * 9 + 5: PRINT SS$(
    I,J)
A7 1110 NEXT
AB 1120 NEXT
DF 1130 RETURN
05 1140 REM CHECK FOR SS SAVE
CA 1150 REM
52 1160 HOME
84 1170 VTAB 4: HTAB 1: PRINT "DO YOU WANT TO SAVE T
    HE SPREADSHEET?"
9F 1180 VTAB 6: HTAB 1: PRINT "TYPE 'Y' OR 'N'.  ->
    ";
0A 1190 GET R$: IF R$ = "" THEN 1190
AD 1200 PRINT R$
63 1210 IF R$ < > "Y" AND R$ < > "N" THEN 1170
F5 1220 IF R$ = "N" THEN 1280
C5 1230 VTAB 12: HTAB 1: PRINT "WHAT IS THE FILE NAM
    E?"
6B 1240 RW = 14:CL = 1:SZ = DW - 1: GOSUB 4630: REM
    LINEINPUT
90 1250 IF A$ = "" THEN 1240
61 1260 GOSUB 1340: REM SAVE SS
7C 1270 GOTO 1330
C0 1280 VTAB 8: HTAB 1: PRINT "ARE YOU SURE (Y/N)? "
    ;
4C 1290 GET R$: IF R$ = "" THEN 1290
AF 1300 PRINT R$
95 1310 IF R$ < > "Y" AND R$ < > "N" THEN 1280
E3 1320 IF R$ = "N" THEN 1230
E3 1330 RETURN
17 1340 REM SAVE SS
CE 1350 REM
96 1360 VTAB 16: HTAB 1: PRINT "SAVING THE FILE.  PL
    EASE WAIT."
24 1370 PRINT D$;"OPEN ";A$
C9 1380 PRINT D$;"WRITE ";A$
D6 1390 PRINT NR: REM NUMBER OF ROWS
88 1400 PRINT NC: REM NUMBER OF COLUMNS
17 1410 FOR I = 1 TO NR: FOR J = 1 TO NC
9B 1420 PRINT SS$(I,J)
39 1430 NEXT : NEXT
23 1440 FOR I = 1 TO NR: FOR J = 1 TO NC
9D 1450 PRINT TP$(I,J)
45 1460 NEXT : NEXT
2F 1470 FOR I = 1 TO NR: FOR J = 1 TO NC
5F 1480 PRINT CF$(I,J)
```

BASICS FOR BUSINESS

```
51 1490 NEXT : NEXT
A8 1500 PRINT D$;"CLOSE ";A$
DF 1510 RETURN
A8 1520 REM OBTAIN AND INTERPRET COMMAND
CA 1530 REM
16 1540 VTAB 1: HTAB 1: PRINT CHR$ (7)
5E 1550 VTAB 19: HTAB 16: PRINT " "
5A 1560 VTAB 19: HTAB 13: PRINT "?:";
8A 1570 GET R$: IF R$ = "" THEN 1570
9B 1580 PRINT
75 1590 IF R$ = CU$ OR R$ = CD$ OR R$ = CL$ OR R$ =
    CR$ THEN GOSUB 1680
CF 1600 IF R$ = "C" OR R$ = "c" THEN GOSUB 1810
84 1610 IF R$ = "E" OR R$ = "e" THEN GOSUB 2060
4F 1620 IF R$ = "F" OR R$ = "f" THEN GOSUB 2130
C3 1630 IF R$ = "L" OR R$ = "l" THEN GOSUB 2230
58 1640 IF R$ = "V" OR R$ = "v" THEN GOSUB 2330
58 1650 IF R$ = "Q" OR R$ = "q" THEN 1670
88 1660 GOTO 1540
F9 1670 RETURN
E5 1680 REM HANDLE CURSOR MOVEMENT
E4 1690 REM
B4 1700 IF R$ = CU$ THEN CR = CR - 1
34 1710 IF R$ = CD$ THEN CR = CR + 1
89 1720 IF R$ = CL$ THEN CC = CC - 1
65 1730 IF R$ = CR$ THEN CC = CC + 1
EE 1740 IF CC < 1 THEN CC = NC
88 1750 IF CC > NC THEN CC = 1
42 1760 IF CR < 1 THEN CR = NR
93 1770 IF CR > NR THEN CR = 1
48 1780 GOSUB 2600: REM RESET DISPLAYED CELL
D8 1790 GOSUB 2450: REM DISPLAY CURRENT CELL
E1 1800 RETURN
D8 1810 REM CALCULATE (COLUMN-WISE)
CC 1820 REM
86 1830 VTAB 19: HTAB 13: PRINT "CALCULATING ..."
D8 1840 FOR C = 1 TO NC
3E 1850 FOR R = 1 TO NR
61 1860 IF CF$(R,C) = "" THEN 1960
D8 1870 F$ = CF$(R,C)
47 1880 NM$ = MID$ ("ABCDEFGH",C,1) + STR$ (R)
30 1890 INVERSE
84 1900 VTAB 19: HTAB 7: PRINT LEFT$ (NM$ + " ",3)
4F 1910 NORMAL
4C 1920 L1 = 20:L2 = 22: GOSUB 3570: REM CLEAR LINES
29 1930 VTAB 20: HTAB 1: PRINT F$
69 1940 GOSUB 2660: REM COMPUTE
D8 1950 IF ER = 1 THEN 2020
9E 1960 NEXT R
93 1970 NEXT C
```

BASICS FOR BUSINESS

```
A6 1980 VTAB 19: HTAB 13: PRINT SPC( 27)
68 1990 L1 = 20:L2 = 22: GOSUB 3570: REM CLEAR LINES
A7 2000 GOSUB 2450: REM DISPLAY CURRENT CELL
3A 2010 RETURN : REM NORMAL EXIT
26 2020 GOSUB 2600: REM RESET DISPLAYED CELL
81 2030 VTAB 19: HTAB 13: PRINT SPC( 27)
CB 2040 CC = C:CR = R: REM CELL IN ERROR IS NOW CURR
    ENT
41 2050 RETURN : REM ERROR EXIT
13 2060 REM ERASE CELL
D1 2070 REM
C0 2080 SS$(CR,CC) = ""
74 2090 TP$(CR,CC) = ""
FF 2100 CF$(CR,CC) = ""
65 2110 GOSUB 2450: REM DISPLAY CELL
DC 2120 RETURN
45 2130 REM ENTER FORMULA
C7 2140 REM
F9 2150 VTAB 21: HTAB 1: PRINT "FORMULA -> "
F0 2160 RW = 22:CL = 1:SZ = DW - 1: GOSUB 4630: REM
    LINE INPUT
1B 2170 IF A$ = "" THEN 2160
B1 2180 CF$(CR,CC) = A$
0F 2190 VTAB 21: HTAB 1: PRINT SPC( DW)
EE 2200 VTAB 22: HTAB 1: PRINT SPC( DW)
67 2210 GOSUB 2450: REM DISPLAY CELL
DE 2220 RETURN
34 2230 REM ENTER LABEL
C9 2240 REM
A4 2250 VTAB 21: HTAB 1: PRINT "ENTER LABEL -> "
6B 2260 RW = 21:CL = 16:SZ = 8: GOSUB 4630: REM LINE
    INPUT
1E 2270 IF A$ = "" THEN 2260
56 2280 SS$(CR,CC) = A$
E7 2290 TP$(CR,CC) = "L"
EE 2300 VTAB 21: HTAB 1: PRINT SPC( DW)
69 2310 GOSUB 2450: REM DISPLAY CELL
E0 2320 RETURN
5A 2330 REM ENTER VALUE
CB 2340 REM
CA 2350 VTAB 21: HTAB 1: PRINT "ENTER VALUE -> "
75 2360 RW = 21:CL = 16:SZ = 9: GOSUB 4630: REM LINE
    INPUT
21 2370 IF A$ = "" THEN 2360
A2 2380 N = VAL (A$)
02 2390 GOSUB 4460: REM PRINT USING
C0 2400 SS$(CR,CC) = N$
D5 2410 TP$(CR,CC) = "V"
F8 2420 VTAB 21: HTAB 1: PRINT SPC( DW)
```

BASICS FOR BUSINESS

```
73 2430 GOSUB 2450: REM DISPLAY CELL
EA 2440 RETURN
33 2450 REM DISPLAY CURRENT CELL POINTED TO BY CR, C
  C
D5 2460 REM
27 2470 SR = CR + 2: SC = (CC - 1) * 9 + 5
E6 2480 NM$ = MID$ ("ABCDEFGH", CC, 1) + STR$ (CR)
9D 2490 TC$ = RIGHT$ (BL$ + SS$(CR, CC), 9)
07 2500 INVERSE
45 2510 VTAB SR: HTAB SC: PRINT TC$
05 2520 VTAB 19: HTAB 7: PRINT LEFT$ (NM$ + " ", 3)
50 2530 NORMAL
4D 2540 L1 = 20: L2 = 22: GOSUB 3570: REM CLEAR LINES
14 2550 IF TP$(CR, CC) = "L" THEN VTAB 20: HTAB 1: PR
  INT "LABEL: "; SS$(CR, CC)
52 2560 IF TP$(CR, CC) = "V" THEN VTAB 20: HTAB 1: PR
  INT "VALUE: "; SS$(CR, CC)
AB 2570 IF CF$(CR, CC) < > "" THEN VTAB 21: HTAB 1: P
  RINT "FORMULA: "
98 2580 IF CF$(CR, CC) < > "" THEN VTAB 22: HTAB 1: P
  RINT CF$(CR, CC)
01 2590 RETURN
E0 2600 REM SET DISPLAYED CELL BACK TO NORMAL
47 2610 VTAB SR: HTAB SC: PRINT TC$
D0 2620 IF ER = 1 THEN 2650
2E 2630 VTAB 19: HTAB 7: PRINT " "
4F 2640 L1 = 20: L2 = 22: GOSUB 3570: REM CLEAR LINES
F2 2650 RETURN
2E 2660 REM EVALUATE FORMULA IN F$
DD 2670 REM
AD 2680 ER = 0: REM RESET ERROR FLAG
B1 2690 P = 1: REM F$ CHARACTER POINTER
98 2700 P1 = 0: P2 = 0: REM OPERAND AND OPERATOR STAC
  K POINTERS
0E 2710 FL = LEN (F$): REM FORMULA LENGTH
AD 2720 REM OBTAIN FIRST OPERAND
62 2730 GOSUB 3040: REM GET CELL OR LITERAL
14 2740 IF ER = 1 THEN 3010
AA 2750 P1 = P1 + 1: S1(P1) = VL: REM PLACE ON OPERAN
  D STACK
3F 2760 REM EVALUATION LOOP
A3 2770 GOSUB 3300: REM GET OPERATOR
24 2780 IF ER = 1 THEN 3010
EB 2790 P2 = P2 + 1: S2$(P2) = OP$: REM PUT ON OPERAT
  OR STACK
20 2800 P = P + 1: REM NEXT CHAR IN F$
5C 2810 GOSUB 3040: REM GET CELL OR LITERAL
0E 2820 IF ER = 1 THEN 3010
6F 2830 P1 = P1 + 1: S1(P1) = VL: REM PUT ON OPERAND
  STACK
```

BASICS FOR BUSINESS

```
6E 2840 IF OP$ = "*" THEN GOSUB 3360: REM MULTIPLY T
    OP 2
CF 2850 IF OP$ = "/" THEN GOSUB 3420: REM DIVIDE TOP
    2
1E 2860 IF ER = 1 THEN 3010
EF 2870 IF P < = FL THEN 2760
AB 2880 REM DO REMAINING ADDS AND SUBTRACTS
E6 2890 FOR I = 1 TO P2
77 2900 IF S2$(I) = "+" THEN GOSUB 3490: REM ADD TOP
    2
BC 2910 IF S2$(I) = "-" THEN GOSUB 3530: REM SUBTRAC
    T TOP 2
BC 2920 NEXT
32 2930 REM PLACE RESULT IN CELL
27 2940 IF P2 = 0 THEN N = S1(1): REM USE TOS
DB 2950 IF P2 < > 0 THEN N = S1(P2 + 1): REM USE BOS
02 2960 GOSUB 4460: REM PRINT USING
CE 2970 SS$(R,C) = N$:TP$(R,C) = "V"
BB 2980 DR = R + 2:DC = (C - 1) * 9 + 5
2B 2990 VTAB DR: HTAB DC: PRINT RIGHT$ (BL$ + N$,9)
D3 3000 RETURN
3F 3010 VTAB 21: HTAB P: PRINT "*"
12 3020 VTAB 22: HTAB 1: PRINT EM$
DF 3030 RETURN
BD 3040 REM GET CELL
CA 3050 REM
82 3060 TL$ = "D": IF DW = 80 THEN TL$ = "H"
96 3070 GOSUB 3640: REM SKIP BLANKS
D3 3080 GOSUB 3700: REM SCAN TO DELIMITER
83 3090 TK$ = MID$ (F$,T1,T2 - T1 + 1)
04 3100 T$ = LEFT$ (TK$,1)
6F 3110 IF T$ < "A" OR T$ > "Z" THEN 3250: REM LITER
    AL
06 3120 IF T$ < = TL$ THEN 3150
CA 3130 ER = 1:EM$ = "COLUMN OUTSIDE THE RANGE A..";
    TL$
88 3140 GOTO 3290
44 3150 TR = VAL ( MID$ (TK$,2) )
2B 3160 IF TR > 0 AND TR < = NR THEN 3190
DD 3170 ER = 1:EM$ = "ROW OUTSIDE THE RANGE 1.." + S
    TR$ (NR)
98 3180 GOTO 3290
7F 3190 TC = ASC (T$) - ASC ("A") + 1
47 3200 IF SS$(TR,TC) < > "" THEN 3230
24 3210 ER = 1:EM$ = "CELL HAS NO VALUE"
82 3220 GOTO 3290
BF 3230 VL = VAL (SS$(TR,TC))
8A 3240 GOTO 3290
B7 3250 VL = VAL (TK$)
6A 3260 IF VL < > 0 THEN 3290
```

BASICS FOR BUSINESS

```
BB 3270 IF VL = 0 AND T$ = "0" THEN 3290
B1 3280 ER = 1:EM$ = "ALPHA OR SPECIAL CHARACTER IN
    A NUMBER"
FB 3290 RETURN
DC 3300 REM GET OPERATOR
C0 3310 REM
BB 3320 GOSUB 3640: REM SKIP BLANKS
D6 3330 GOSUB 3700: REM SCAN FOR DELIMITER
9F 3340 OP$ = C$
ED 3350 RETURN
90 3360 REM MULTIPLY TOP 2
D8 3370 REM
19 3380 S1(P1 - 1) = S1(P1) * S1(P1 - 1)
98 3390 P1 = P1 - 1: REM POP OPERAND
4B 3400 P2 = P2 - 1: REM POP OPERATOR
DF 3410 RETURN
F3 3420 REM DIVIDE TOP 2
CA 3430 REM
EB 3440 IF S1(P1) = 0 THEN ER = 1:EM$ = "CAN'T DIVID
    E BY ZERO": GOTO 2970
EC 3450 S1(P1 - 1) = S1(P1 - 1) / S1(P1)
8E 3460 P1 = P1 - 1: REM POP OPERAND
67 3470 P2 = P2 - 1: REM POP OPERATOR
FB 3480 RETURN
72 3490 REM ADD LEFT-RIGHT
C0 3500 REM
53 3510 S1(I + 1) = S1(I + 1) + S1(I)
E5 3520 RETURN
D1 3530 REM SUBTRACT LEFT-RIGHT
D0 3540 REM
37 3550 S1(I + 1) = S1(I) - S1(I + 1)
F5 3560 RETURN
16 3570 REM CLEAR LINES L1-L2
E0 3580 REM
1C 3590 FOR Z = L1 TO L2
87 3600 PRINT CHR$(25): VTAB Z: HTAB 1: PRINT SPC(
    DW)
B3 3610 NEXT
59 3620 PRINT CHR$(25)
EB 3630 RETURN
E7 3640 REM SKIP BLANKS
D6 3650 REM
1E 3660 IF P > FL THEN 3690
44 3670 IF MID$(F$,P,1) < > " " THEN 3690
C4 3680 P = P + 1: GOTO 3660
04 3690 RETURN
2F 3700 REM SCAN TO DELIMITER
C8 3710 REM
CE 3720 T1 = P
92 3730 IF P > FL THEN 3770
```


BASICS FOR BUSINESS

```
19 3740 C$ = MID$ (F$,P,1)
C2 3750 IF C$ = "+" OR C$ = "-" OR C$ = "*" OR C$ =
    "/" OR C$ = " " THEN 3770
3C 3760 P = P + 1: GOTO 3730
D0 3770 T2 = P - 1: IF T2 < 1 THEN T2 = 1
02 3780 RETURN
D7 3790 REM DISPLAY SS TEMPLATE
C6 3800 REM
1D 3810 HOME : INVERSE
4F 3820 VTAB 1: HTAB 1: PRINT SPC( DW)
B2 3830 FOR I = 1 TO 3: FOR J = 1 TO 17: HTAB I: VTA
    B J: PRINT " ": NEXT : NEXT
FF 3840 VTAB 1: HTAB 9: PRINT "A"
B3 3850 VTAB 1: HTAB 18: PRINT "B"
F7 3860 VTAB 1: HTAB 27: PRINT "C"
3C 3870 VTAB 1: HTAB 36: PRINT "D"
67 3880 IF DW = 40 THEN 3930
84 3890 VTAB 1: HTAB 45: PRINT "E"
A2 3900 VTAB 1: HTAB 54: PRINT "F"
E6 3910 VTAB 1: HTAB 63: PRINT "G"
2B 3920 VTAB 1: HTAB 72: PRINT "H"
40 3930 FOR I = 1 TO 15
C5 3940 VTAB I + 2: HTAB 1
BB 3950 IF I < 10 THEN PRINT " ";
31 3960 PRINT I
D1 3970 NEXT
6D 3980 NORMAL
93 3990 VTAB 19: HTAB 1: PRINT "CELL < >"
A4 4000 IF DW = 40 THEN T$ = " "
B0 4010 IF DW = 80 THEN T$ = " "
12 4020 VTAB 23: HTAB 1: PRINT "CALC";T$;"ERASE";T$;
    "FORMULA";T$;"LABEL";T$;"VALUE";T$;"QUIT"
0B 4030 INVERSE
C6 4040 IF DW = 80 THEN 4120
51 4050 VTAB 23: HTAB 1: PRINT "C"
D8 4060 VTAB 23: HTAB 6: PRINT "E"
B9 4070 VTAB 23: HTAB 12: PRINT "F"
42 4080 VTAB 23: HTAB 20: PRINT "L"
56 4090 VTAB 23: HTAB 26: PRINT "V"
AB 4100 VTAB 23: HTAB 32: PRINT "Q"
78 4110 GOTO 4180
47 4120 VTAB 23: HTAB 1: PRINT "C"
50 4130 VTAB 23: HTAB 9: PRINT "E"
B5 4140 VTAB 23: HTAB 18: PRINT "F"
41 4150 VTAB 23: HTAB 29: PRINT "L"
CE 4160 VTAB 23: HTAB 38: PRINT "V"
4D 4170 VTAB 23: HTAB 47: PRINT "Q"
5E 4180 NORMAL
FA 4190 RETURN
43 4200 REM INITIALIZE SPREADSHEET
```

BASICS FOR BUSINESS

```
BF 4210 REM
A4 4220 FOR I = 1 TO NR
47 4230 FOR J = 1 TO NC
EB 4240 SS$(I,J) = "":TP$(I,J) = "":CF$(I,J) = ""
BC 4250 NEXT
C0 4260 NEXT
F4 4270 RETURN
B5 4280 REM SET CURSOR MOVEMENT VALUES
DF 4290 REM
9F 4300 CU$ = CHR$(11):CD$ = CHR$(10):CL$ = CHR$(
      8):CR$ = CHR$(21)
AD 4310 IF PEEK(64435) = 06 THEN 4330: REM IIE OR I
      IC
58 4320 CU$ = CHR$(05):CD$ = CHR$(24):CL$ = CHR$(
      19):CR$ = CHR$(4)
E6 4330 RETURN
BD 4340 REM TITLE SCREEN
D1 4350 REM
28 4360 HOME : INVERSE
9D 4370 VTAB 1: HTAB 1: PRINT SPC(40)
B8 4380 FOR I = 1 TO 3: FOR J = 1 TO 17: HTAB I: VTA
      B J: PRINT " ";: NEXT : NEXT
66 4390 NORMAL
3E 4400 VTAB 8: HTAB 15: PRINT "QUICK-SPREAD"
FE 4410 VTAB 10: HTAB 20: PRINT "AN"
60 4420 VTAB 12: HTAB 10: PRINT "ELECTRONIC SPREADSH
      EET"
EE 4430 FOR I = 1 TO 6000: NEXT
53 4440 HOME
F0 4450 RETURN
6F 4460 REM -- PRINT USING SUBROUTINE
BD 4470 LET ZA$ = "*****"
54 4480 LET ZB$ = "":ZZ$ = "0000000000":Z9$
      = "9999999999"
1C 4490 IF N < 0 THEN ZS$ = "-"
40 4500 IF N >= 0 THEN ZS$ = " "
EB 4510 LET ZN = ABS(N) + 5 * 10 ^ - (DA + 1)
51 4520 LET ZM$ = "0": IF DB > 0 THEN ZM$ = LEFT$(Z
      9$,DB)
58 4530 IF DA > 0 THEN ZM$ = ZM$ + "." + LEFT$(Z9$,
      DA)
70 4540 IF ZN > VAL(ZM$) THEN 4600
9D 4550 LET ZW = INT(ZN):ZF = INT((ZN - ZW) * 10 ^
      DA)
2F 4560 IF DA > 0 THEN ZF$ = RIGHT$(ZZ$ + STR$(ZF)
      ,DA)
9B 4570 LET N$ = RIGHT$(ZB$ + ZS$ + STR$(ZW),DB +
      1 + (DB = 0))
3D 4580 IF DA > 0 THEN N$ = N$ + "." + LEFT$(ZF$ +
      ZZ$,DA)
```

BASICS FOR BUSINESS

```
03 4590 RETURN
81 4600 LET ZS = DB + DA + 2: IF DB = 0 THEN ZS = ZS
    + 1
7F 4610 LET N$ = LEFT$ (ZA$, ZS)
E8 4620 RETURN
B8 4630 REM -- LINE INPUT DRIVER
CD 4640 GOSUB 4680: REM LINE INPUT
D8 4650 PRINT CHR$ (25): VTAB RW: HTAB CL: PRINT SPC
    ( SZ)
9C 4660 PRINT CHR$ (25): VTAB RW: HTAB CL: PRINT A$
FC 4670 RETURN
06 4680 REM -- LINE INPUT SUBROUTINE
18 4690 LET ZT$ = "": A$ = "": ZP = 0
75 4700 FOR ZI = 1 TO SZ: ZT$ = ZT$ + " ": NEXT
6A 4710 PRINT CHR$ (25): VTAB RW: HTAB CL
BF 4720 INVERSE : PRINT ZT$: VTAB RW: HTAB CL
5D 4730 GET ZC$
D9 4740 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
A1 4750 IF ZC$ = CHR$ (24) THEN 4690: REM CTRL-X
1D 4760 IF ZC$ = CHR$ (8) THEN 4820: REM LEFT ARROW
3C 4770 IF ZC$ = CHR$ (13) THEN 4870: REM CR
0E 4780 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    4730
A7 4790 IF ZP < SZ THEN PRINT CHR$ (25): VTAB RW: HT
    AB CL + ZP: PRINT ZC$;: A$ = A$ + ZC$
6A 4800 LET ZP = ZP + 1: IF ZP > = SZ THEN 4870
7E 4810 GOTO 4730
72 4820 VTAB RW: HTAB CL + ZP: PRINT " ": ZP = ZP - 1
    : IF ZP < 0 THEN ZP = 0: REM BACKSPACE
C6 4830 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
D8 4840 IF LEN (A$) < = 1 THEN A$ = ""
65 4850 IF LEN (A$) > 1 THEN A$ = LEFT$ (A$, LEN (A$
    ) - 1)
92 4860 GOTO 4730
5A 4870 NORMAL : REM CR
A4 4880 PRINT
09 4890 RETURN
```

Program 6-2. QUICK.FORMULA

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
D8 100 REM ELECTRONIC SPREADSHEET FORMULA PRINTER (Q
    UICK.FORMULA)
84 110 REM
13 120 HOME : D$ = CHR$ (4): PRINT CHR$ (21)
B8 130 REM
0C 140 REM DW CONTROLS DISPLAY WIDTH. SET DW TO EITH
    ER 40 OR 80
```

BASICS FOR BUSINESS

```
8C 150 REM
C3 160 DW = 80
60 170 NR = 15:NC = INT (DW / 10): REM NUMBER ROWS A
    ND COLUMNS
73 180 DIM SS$(NR,NC): REM SPREADSHEET
A2 190 DIM TP$(NR,NC): REM CELL TYPE
74 200 DIM CF$(NR,NC): REM CALCULATION FORMULA
99 210 PS = 55: REM PAGE SIZE - PRINT 55 LINES
41 220 FF$ = CHR$ (12): REM FORM FEED
AF 230 BL$ = "          ": REM 15 BLANKS
8B 240 REM
C1 250 REM INITIALIZATION SECTION
8F 260 REM
31 270 GOSUB 1570: REM TITLE SCREEN
93 280 REM
36 290 REM SEE IF THERE IS AN INPUT FILE
84 300 REM
84 310 GOSUB 440: REM CHECK INPUT
F4 320 IF Q < > 0 THEN 380
8A 330 REM
38 340 REM PRINT FORMULAS AND LABELS
8E 350 REM
3D 360 GOSUB 880: REM PRINT
92 370 REM
D3 380 REM ALL DONE
96 390 REM
CB 400 PRINT CHR$ (21)
07 410 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C4 420 PRINT : PRINT : PRINT
92 430 END
65 440 REM CHECK FOR SS LOAD
8F 450 REM
12 460 HOME : PRINT
67 470 Q = 0
0A 480 VTAB 6: HTAB 1: PRINT "DO YOU WANT TO PRINT S
    PREADSHEET"
5C 490 VTAB 8: HTAB 1: PRINT "FORMULAS AND LABELS?"
E1 500 VTAB 10: HTAB 1: PRINT "TYPE 'Y' OR 'N'. ->
    "
C5 510 GET R$: IF R$ = "" THEN 510
05 520 PRINT R$
9D 530 IF R$ < > "Y" AND R$ < > "N" THEN 480
98 540 IF R$ = "N" THEN Q = 1: GOTO 630
13 550 VTAB 14: HTAB 1: PRINT "WHAT IS THE FILE NAME
    ?"
E8 560 RW = 16:CL = 1:SZ = 39: GOSUB 1690: REM LINE
    INPUT
14 570 IF A$ = "" THEN 560
F9 580 VTAB 18: HTAB 1: PRINT SPC( 40)
85 590 ONERR GOTO 650
```

BASICS FOR BUSINESS

```
4B 600 PRINT D$;"VERIFY ";A$
64 610 POKE 216,0: REM DISABLE ONERR
5F 620 GOSUB 680: REM LOAD SPREADSHEET
4F 630 HOME
1E 640 RETURN
43 650 VTAB 18: HTAB 1: PRINT "THE FILE CANNOT BE LO
    CATED. TRY AGAIN."
9D 660 CALL - 3288: REM FIX STACK
A4 670 GOTO 550
84 680 REM LOAD SPREADSHEET
99 690 REM
D4 700 VTAB 18: HTAB 1: PRINT "READING THE FILE. PL
    EASE WAIT."
31 710 PRINT D$;"OPEN ";A$
FB 720 PRINT D$;"READ ";A$
7E 730 INPUT R: REM NUMBER OF ROWS
0A 740 INPUT C: REM NUMBER OF COLS
01 750 FOR I = 1 TO R: FOR J = 1 TO C
3B 760 INPUT T$
22 770 IF T$ < > "" THEN SS$(I,J) = RIGHT$ (BL$ + T$
    ,9)
A7 780 IF T$ = "" THEN SS$(I,J) = ""
D2 790 NEXT : NEXT
F7 800 FOR I = 1 TO R: FOR J = 1 TO C
1C 810 INPUT TP$(I,J)
C5 820 NEXT : NEXT
FD 830 FOR I = 1 TO R: FOR J = 1 TO C
FC 840 INPUT CF$(I,J)
CB 850 NEXT : NEXT
0C 860 PRINT D$;"CLOSE ";A$
26 870 RETURN
45 880 REM PRINT FORMULAS AND LABELS
9B 890 REM
5E 900 Q = 0
63 910 GOSUB 980: REM CHECK PRINTER READY
D1 920 IF Q = 1 THEN 970
2E 930 GOSUB 1060: REM OPEN PRINTER
D5 940 GOSUB 1160: REM PRINT FORMULAS
BB 950 GOSUB 1330: REM PRINT LABELS
52 960 PRINT D$;"PR#0"
27 970 RETURN
87 980 REM CHECK PRINTER READY
9C 990 REM
3B 1000 HOME
FC 1010 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY WHEN R
    EADY TO PRINT."
23 1020 VTAB 16: HTAB 1: PRINT "PRESS 'ESC' TO QUIT
    NOW."
AC 1030 GET R$: IF R$ = "" THEN 1030
D0 1040 IF ASC (R$) = 27 THEN Q = 1
```

BASICS FOR BUSINESS

```
E5 1050 RETURN
C2 1060 REM OPEN PRINTER
D0 1070 REM
58 1080 HOME
E6 1090 VTAB 12: HTAB 1: PRINT "PRINTING. PLEASE WAIT."
2F 1100 PRINT D$;"PR#1"
0B 1110 REM ADD PRINTER INITIALIZATION COMMANDS HERE
BE 1120 REM
C2 1130 REM
C6 1140 REM
E7 1150 RETURN
96 1160 REM PRINT FORMULAS
D2 1170 REM
8A 1180 LC = 0
91 1190 PRINT "SPREADSHEET: ";A$;" FORMULAS"
75 1200 PRINT
71 1210 LC = 2
BC 1220 FOR C = 1 TO NC
2A 1230 FOR R = 1 TO NR
0D 1240 IF CF$(R,C) = "" THEN 1290
73 1250 T1$ = "CELL: "
30 1260 T2$ = MID$ ("ABCDEFGH",C,1) + STR$(R)
F9 1270 PRINT LEFT$(T1$ + T2$ + BL$,15);CF$(R,C)
1B 1280 GOSUB 1500: REM CHECK LINE COUNT
9C 1290 NEXT R
6B 1300 NEXT C
AB 1310 IF LC < > 0 THEN PRINT FF$
DF 1320 RETURN
84 1330 REM PRINT LABELS
CA 1340 REM
82 1350 LC = 0
DF 1360 PRINT "SPREADSHEET: ";A$;" LABELS"
93 1370 PRINT
8F 1380 LC = 2
DA 1390 FOR C = 1 TO NC
22 1400 FOR R = 1 TO NR
45 1410 IF TP$(R,C) < > "L" THEN 1460
6B 1420 T1$ = "CELL: "
2B 1430 T2$ = MID$ ("ABCDEFGH",C,1) + STR$(R)
07 1440 PRINT LEFT$(T1$ + T2$ + BL$,15);SS$(R,C)
13 1450 GOSUB 1500: REM CHECK LINE COUNT
94 1460 NEXT R
89 1470 NEXT C
C9 1480 IF LC < > 0 THEN PRINT FF$
FD 1490 RETURN
7D 1500 REM CHECK LINE COUNT
C2 1510 REM
6A 1520 LC = LC + 1
D2 1530 IF LC < = PS THEN 1560
```


BASICS FOR BUSINESS

```
D0 1540 PRINT FF$: REM FORM FEED
86 1550 LC = 0
F3 1560 RETURN
CA 1570 REM TITLE SCREEN
DE 1580 REM
35 1590 HOME : INVERSE
84 1600 VTAB 1: HTAB 1: PRINT SPC( 40)
9F 1610 FOR I = 1 TO 3: FOR J = 1 TO 17: HTAB I: VTA
    B J: PRINT " "; NEXT : NEXT
4D 1620 NORMAL
4B 1630 VTAB 8: HTAB 15: PRINT "QUICK-SPREAD"
65 1640 VTAB 10: HTAB 10: PRINT "ELECTRONIC SPREADSH
    EET"
44 1650 VTAB 12: HTAB 13: PRINT "FORMULA PRINTER"
FB 1660 FOR I = 1 TO 6000: NEXT
60 1670 HOME
FD 1680 RETURN
CD 1690 REM -- LINE INPUT DRIVER
9A 1700 GOSUB 1740: REM LINE INPUT
BF 1710 PRINT CHR$( 25): VTAB RW: HTAB CL: PRINT SPC
    ( SZ)
8B 1720 PRINT CHR$( 25): VTAB RW: HTAB CL: PRINT A$
EB 1730 RETURN
F4 1740 REM -- LINE INPUT SUBROUTINE
07 1750 LET ZT$ = "": A$ = "": ZP = 0
8A 1760 FOR ZI = 1 TO SZ: ZT$ = ZT$ + " ": NEXT
7F 1770 PRINT CHR$( 25): VTAB RW: HTAB CL
D4 1780 INVERSE : PRINT ZT$: VTAB RW: HTAB CL
72 1790 GET ZC$
C8 1800 IF ZC$ = CHR$( 3) THEN STOP : REM CTRL-C
4C 1810 IF ZC$ = CHR$( 24) THEN 1750: REM CTRL-X
AE 1820 IF ZC$ = CHR$( 8) THEN 1880: REM LEFT ARROW
E6 1830 IF ZC$ = CHR$( 13) THEN 1930: REM CR
9F 1840 IF ZC$ < CHR$( 32) OR ZC$ > CHR$( 127) THEN
    1790
96 1850 IF ZP < SZ THEN PRINT CHR$( 25): VTAB RW: HT
    AB CL + ZP: PRINT ZC$: A$ = A$ + ZC$
F6 1860 LET ZP = ZP + 1: IF ZP > = SZ THEN 1930
A8 1870 GOTO 1790
87 1880 VTAB RW: HTAB CL + ZP: PRINT " ": ZP = ZP - 1
    : IF ZP < 0 THEN ZP = 0: REM BACKSPACE
DB 1890 PRINT CHR$( 25): VTAB RW: HTAB CL + ZP
C7 1900 IF LEN (A$) < = 1 THEN A$ = ""
54 1910 IF LEN (A$) > 1 THEN A$ = LEFT$ (A$, LEN (A$
    ) - 1)
96 1920 GOTO 1790
49 1930 NORMAL : REM CR
93 1940 PRINT
F7 1950 RETURN
```

Program 6-3. QUICK.PRINT

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
09 100 REM ELECTRONIC SPREADSHEET REPORT PRINTER (QU
    ICK.PRINT)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
88 130 REM
0C 140 REM DW CONTROLS DISPLAY WIDTH. SET DW TO EITH
    ER 40 OR 80
8C 150 REM
C3 160 DW = 80
60 170 NR = 15:NC = INT (DW / 10): REM NUMBER ROWS A
    ND COLUMNS
73 180 DIM SS$(NR,NC): REM SPREADSHEET
A2 190 DIM TP$(NR,NC): REM CELL TYPE
74 200 DIM CF$(NR,NC): REM CALCULATION FORMULA
3F 210 FF$ = CHR$ (12): REM FORM FEED
AD 220 BL$ = "                ": REM 15 BLANKS
89 230 REM
BF 240 REM INITIALIZATION SECTION
8D 250 REM
13 260 GOSUB 1310: REM TITLE SCREEN
91 270 REM
34 280 REM SEE IF THERE IS AN INPUT FILE
95 290 REM
80 300 GOSUB 430: REM CHECK INPUT
B2 310 IF Q < > 0 THEN 370
88 320 REM
E9 330 REM PRINT SPREADSHEET REPORT
8C 340 REM
39 350 GOSUB 870: REM PRINT
90 360 REM
D1 370 REM ALL DONE
94 380 REM
DC 390 PRINT CHR$ (21)
05 400 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C2 410 PRINT : PRINT : PRINT
90 420 END
63 430 REM CHECK FOR SS LOAD
8D 440 REM
10 450 HOME : PRINT
65 460 Q = 0
12 470 VTAB 6: HTAB 1: PRINT "DO YOU WANT TO PRINT A
    "
29 480 VTAB 8: HTAB 1: PRINT "SPREADSHEET REPORT?"
F2 490 VTAB 10: HTAB 1: PRINT "TYPE 'Y' OR 'N'. ->
    ";
```

BASICS FOR BUSINESS

```
A3 500 GET R$: IF R$ = "" THEN 500
03 510 PRINT R$
93 520 IF R$ < > "Y" AND R$ < > "N" THEN 470
95 530 IF R$ = "N" THEN Q = 1: GOTO 620
11 540 VTAB 14: HTAB 1: PRINT "WHAT IS THE FILE NAME
?"
AE 550 RW = 16: CL = 1: SZ = 39: GOSUB 1430: REM LINE
INPUT
91 560 IF A$ = "" THEN 550
F7 570 VTAB 18: HTAB 1: PRINT SPC( 40)
93 580 ONERR GOTO 640
5C 590 PRINT D$;"VERIFY ";A$
62 600 POKE 216,0: REM DISABLE ONERR
5B 610 GOSUB 670: REM LOAD SPREADSHEET
4D 620 HOME
1C 630 RETURN
41 640 VTAB 18: HTAB 1: PRINT "THE FILE CANNOT BE LO
CATED. TRY AGAIN."
9B 650 CALL - 3288: REM FIX STACK
A1 660 GOTO 540
82 670 REM LOAD SPREADSHEET
97 680 REM
E5 690 VTAB 18: HTAB 1: PRINT "READING THE FILE. PL
EASE WAIT."
2F 700 PRINT D$;"OPEN ";A$
F9 710 PRINT D$;"READ ";A$
7C 720 INPUT R: REM NUMBER OF ROWS
0B 730 INPUT C: REM NUMBER OF COLS
FE 740 FOR I = 1 TO R: FOR J = 1 TO C
39 750 INPUT T$
20 760 IF T$ < > "" THEN SS$(I,J) = RIGHT$(BL$ + T$
,9)
A5 770 IF T$ = "" THEN SS$(I,J) = ""
D0 780 NEXT : NEXT
09 790 FOR I = 1 TO R: FOR J = 1 TO C
1A 800 INPUT TP$(I,J)
C3 810 NEXT : NEXT
FB 820 FOR I = 1 TO R: FOR J = 1 TO C
FA 830 INPUT CF$(I,J)
C9 840 NEXT : NEXT
0A 850 PRINT D$;"CLOSE ";A$
24 860 RETURN
F6 870 REM PRINT SPREADSHEET REPORT
99 880 REM
6F 890 Q = 0
5D 900 GOSUB 960: REM CHECK PRINTER READY
FB 910 IF Q < > 0 THEN 950
24 920 GOSUB 1040: REM OPEN PRINTER
9A 930 GOSUB 1140: REM PRINT REPORT
4E 940 PRINT D$;"PR#0"
```

BASICS FOR BUSINESS

```
23 950 RETURN
83 960 REM CHECK PRINTER READY
98 970 REM
5C 980 HOME
BE 990 VTAB 12: HTAB 1: PRINT "PRESS ANY KEY WHEN RE
    ADY TO PRINT."
1B 1000 VTAB 16: HTAB 1: PRINT "PRESS 'ESC' TO QUIT
    NOW."
A3 1010 GET R$: IF R$ = "" THEN 1010
C8 1020 IF ASC (R$) = 27 THEN Q = 1
DD 1030 RETURN
BA 1040 REM OPEN PRINTER
C8 1050 REM
50 1060 HOME
DE 1070 VTAB 12: HTAB 1: PRINT "PRINTING. PLEASE WA
    IT."
4D 1080 PRINT D$; "PR#1"
29 1090 REM ADD PRINTER INITIALIZATION COMMANDS HERE
B6 1100 REM
BA 1110 REM
BE 1120 REM
DF 1130 RETURN
F5 1140 REM PRINT REPORT
CA 1150 REM
40 1160 PRINT "SPREADSHEET: "; A$
49 1170 PRINT : PRINT : PRINT
99 1180 S = 1: IF C = 4 THEN S = 20
ED 1190 PRINT SPC( S);
55 1200 FOR I = 1 TO C: PRINT SPC( 8); MID$ ("ABCDEF
    GH", I, 1); : NEXT : PRINT
79 1210 PRINT
FE 1220 FOR RR = 1 TO R
84 1230 PRINT SPC( S); RIGHT$ ( "    " + STR$ (RR), 3);
    " ";
8E 1240 FOR CC = 1 TO C
9E 1250 PRINT RIGHT$ (BL$ + SS$(RR, CC), 9);
09 1260 NEXT CC
91 1270 PRINT
3E 1280 NEXT RR
67 1290 PRINT FF$
D7 1300 RETURN
AE 1310 REM TITLE SCREEN
C2 1320 REM
19 1330 HOME : INVERSE
8E 1340 VTAB 1: HTAB 1: PRINT SPC( 40)
A9 1350 FOR I = 1 TO 3: FOR J = 1 TO 17: HTAB I: VTA
    B J: PRINT " "; : NEXT : NEXT
57 1360 NORMAL
55 1370 VTAB 8: HTAB 15: PRINT "QUICK-SPREAD"
```

BASICS FOR BUSINESS

```
6F 1380 VTAB 10: HTAB 10: PRINT "ELECTRONIC SPREADSH
    EET"
A7 1390 VTAB 12: HTAB 14: PRINT "REPORT PRINTER"
DF 1400 FOR I = 1 TO 6000: NEXT
44 1410 HOME
E1 1420 RETURN
B1 1430 REM -- LINE INPUT DRIVER
BB 1440 GOSUB 1480: REM LINE INPUT
C9 1450 PRINT CHR$ (25): VTAB RW: HTAB CL: PRINT SPC
    ( SZ)
95 1460 PRINT CHR$ (25): VTAB RW: HTAB CL: PRINT A$
F5 1470 RETURN
FE 1480 REM -- LINE INPUT SUBROUTINE
11 1490 LET ZT$ = "":A$ = "":ZP = 0
6E 1500 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT
63 1510 PRINT CHR$ (25): VTAB RW: HTAB CL
BB 1520 INVERSE : PRINT ZT$: VTAB RW: HTAB CL
56 1530 GET ZC$
D2 1540 IF ZC$ = CHR$ (3) THEN STOP : REM CTRL-C
D8 1550 IF ZC$ = CHR$ (24) THEN 1490: REM CTRL-X
35 1560 IF ZC$ = CHR$ (8) THEN 1620: REM LEFT ARROW
73 1570 IF ZC$ = CHR$ (13) THEN 1670: REM CR
26 1580 IF ZC$ < CHR$ (32) OR ZC$ > CHR$ (127) THEN
    1530
A0 1590 IF ZP < SZ THEN PRINT CHR$ (25): VTAB RW: HT
    AB CL + ZP: PRINT ZC$;:A$ = A$ + ZC$
2B 1600 LET ZP = ZP + 1: IF ZP > = SZ THEN 1670
70 1610 GOTO 1530
6B 1620 VTAB RW: HTAB CL + ZP: PRINT " ":ZP = ZP - 1
    : IF ZP < 0 THEN ZP = 0: REM BACKSPACE
BF 1630 PRINT CHR$ (25): VTAB RW: HTAB CL + ZP
D1 1640 IF LEN (A$) < = 1 THEN A$ = ""
5E 1650 IF LEN (A$) > 1 THEN A$ = LEFT$ (A$, LEN (A$
    ) - 1)
84 1660 GOTO 1530
53 1670 NORMAL : REM CR
9D 1680 PRINT
02 1690 RETURN
```

TAX DEPRECIATION SCHEDULE

Program 6-4 computes what accountants call a tax depreciation schedule on an investment. In lay terms, this is the amount of money you can deduct on your income taxes each year due to the decreasing value of a piece of equipment.

Suppose, for example, that you buy a deluxe machine for making shoes. With all the latest features, it costs \$50,000. You expect it to last a couple of decades and to be worth \$1,000 as scrap when it finally falls apart.

Using "Tax Depreciation Schedule," you enter \$50,000 for the size of your initial investment, 20 years for the span of its useful life, and \$1,000 for the salvage value.

The Apple depreciates the lump sum \$49,000 (\$50,000 minus the \$1,000 scrap value) over 20 years and displays these amounts:

Year	Amount Depreciated	Amount Remaining
1	\$4666	\$44334
2	4433	39901
3	4200	35701
.	.	.
.	.	.
19	466	240
20	240	0

You can claim \$4,666 in depreciation on your tax return in the first year, \$4,433 in the second year, and so on.

Technical note. The program uses the sum-of-digits method of computing depreciation. The name comes from the calculation made in line 1270 in the program. The variable N is the number of years of useful life for the machine, or 20 in the example. The formula $N*(N+1)/2$ represents the sum of all the integers from 1 to N , inclusive.

Program 6-4. Tax Depreciation Schedule

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
08 100 REM TAX DEPRECIATION SCHEDULE
A6 110 REM INITIALIZE
4B 120 GOSUB 270
5A 130 REM ENTER DATA
4D 140 GOSUB 640
7A 150 REM EDIT DATA
58 160 GOSUB 770
33 170 REM COMPUTE
D5 180 GOSUB 1210
FE 190 REM DISPLAY
05 200 IF ETYPE = 0 THEN GOSUB 1450
A8 210 VTAB 23: HTAB 11: PRINT "ANOTHER RUN (Y/N) ?
";BELL$;
57 220 GET S$
DA 230 IF S$ = "Y" OR S$ = "y" THEN 160
D2 240 IF S$ < > "N" AND S$ < > "n" THEN 210
A8 250 HOME : PRINT "BYE-BYE"
96 260 END
B3 270 REM INITIALIZE
55 280 : REM TITLE
57 290 GOSUB 350
B2 300 : REM KEY VALUES
3F 310 GOSUB 400
FC 320 : REM INSTRUCTIONS
4A 330 GOSUB 530
1B 340 RETURN
2E 350 REM TITLE
31 360 PRINT CHR$ (21): TEXT : HOME
70 370 VTAB 12: HTAB 7: PRINT "TAX DEPRECIATION SCHE
DULE"
85 380 FOR PAUSE = 1 TO 1500: NEXT
25 390 RETURN
5B 400 REM KEY VALUES
BC 410 : REM MAX NUMBER OF YEARS
9A 420 DATA 250
FA 430 READ MX
91 440 DIM DPR(MX),BAL(MX)
98 450 : REM DATA ITEMS
51 460 DATA INITIAL INVESTMENT,SALVAGE VALUE,YEARS O
F LIFE
FD 470 FOR I = 1 TO 3
51 480 READ DT$(I)
0E 490 NEXT
5C 500 L$ = "": FOR I = 1 TO 39:L$ = L$ + CHR$ (61):
NEXT
BA 510 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
```

BASICS FOR BUSINESS

```
19 520 RETURN
85 530 REM INSTRUCTIONS
50 540 HOME
AE 550 PRINT "THIS PROGRAM TALLIES THE ANNUAL DEPREC
_"
F2 560 PRINT "IATION IN VALUE OF A CAPITAL ASSET."
F2 570 PRINT
90 580 PRINT "YOU'LL NEED TO ENTER THE ASSET'S INITI
AL";
16 590 PRINT "VALUE, ITS WORTH AS SCRAP, AND THE"
EC 600 PRINT "LENGTH OF ITS USEFUL LIFE."
60 610 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
58 620 GET S$
1C 630 RETURN
61 640 REM ENTER DATA
53 650 HOME
C8 660 PRINT "PLEASE ENTER YOUR DATA:"
FF 670 FOR I = 1 TO 3
54 680 VTAB I * 2 + 2: HTAB 1: PRINT DT$(I); " = ?";:
COL = POS (0) + 1
7F 690 VTAB I * 2 + 2: HTAB COL: PRINT SPC( 20):CLIC
K = PEEK (Z)
4C 700 VTAB I * 2 + 2: HTAB COL: INPUT " ";S$
B2 710 V = INT ( VAL (S$)):D(I) = V
97 720 IF (I = 1 AND V < = 0) OR (I = 2 AND V < 0) O
R (I = 3 AND V < 1) THEN 690
CC 730 IF I = 1 OR I = 2 THEN D$(I) = "$" + STR$ (V)
21 740 IF I = 3 THEN D$(I) = STR$ (V)
09 750 NEXT
23 760 RETURN
DD 770 REM EDIT
EF 780 : REM DISPLAY
5D 790 GOSUB 830
B3 800 : REM CORRECT
4F 810 GOSUB 930
1C 820 RETURN
F9 830 REM DISPLAY
53 840 HOME
08 850 PRINT L$
CE 860 PRINT TAB( 15)"YOUR DATA"
0C 870 PRINT L$
04 880 FOR I = 1 TO 3
19 890 VTAB 2 * I + 3: HTAB 1: INVERSE : PRINT CHR$
(I + 64);: NORMAL : PRINT CHR$ (32);DT$(I); T
AB( 22)"= ";D$(I)
01 900 NEXT
F9 910 VTAB 12: HTAB 1: PRINT L$
1D 920 RETURN
64 930 REM CORRECT
94 940 VTAB 16: HTAB 1: PRINT SPC( 9)
```

BASICS FOR BUSINESS

```
F7 950 VTAB 18: HTAB 1: PRINT SPC( 40)
68 960 VTAB 14: HTAB 1: PRINT "CHANGES (Y/N) ? ";:CL
    ICK = PEEK (Z)
68 970 GET S$
DC 980 A = ASC (S$): IF A > 96 THEN A = A - 32
4D 990 S$ = CHR$ (A)
8A 1000 IF S$ = "N" THEN 1200
2C 1010 IF S$ < > "Y" THEN 960
BA 1020 : REM ITEM
2C 1030 VTAB 16: HTAB 1: INVERSE : PRINT "LETTER:":;:
    NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
64 1040 GET S$
4D 1050 A = ASC (S$): IF A > 96 THEN A = A - 32
AF 1060 Q = A - 64
E7 1070 IF Q < 1 OR Q > 3 THEN 1030
77 1080 PRINT CHR$ (A)
54 1090 VTAB 2 * Q + 3: HTAB 24: INVERSE : PRINT D$(
    Q): NORMAL
3A 1100 : REM NEW VALUE
85 1110 VTAB 18: HTAB 12: PRINT SPC( 20):CLICK = PEE
    K (Z)
28 1120 VTAB 18: HTAB 1: INVERSE : PRINT "NEW VALUE:
    ";: NORMAL
53 1130 INPUT " ";S$
CC 1140 V = INT ( VAL (S$)):S$ = STR$ (V):D(Q) = V
1E 1150 IF D(1) < = 0 OR D(2) < 0 OR D(3) < 1 THEN 1
    110
84 1160 IF Q = 1 OR Q = 2 THEN D$(Q) = "$" + S$
DA 1170 IF Q = 3 THEN D$(3) = S$
30 1180 VTAB 2 * Q + 3: HTAB 24: PRINT SPC( 16);: HT
    AB 24: PRINT D$(Q)
FA 1190 GOTO 940
D5 1200 RETURN
02 1210 REM COMPUTE
44 1220 HOME
9F 1230 VTAB 12: HTAB 16: PRINT "COMPUTING"
49 1240 ETYPE = 0
97 1250 DLTA = D(1) - D(2): IF DLTA < 0 THEN ETYPE =
    1: GOSUB 1380: GOTO 1370
5E 1260 N = D(3): IF N > MX THEN ETYPE = 2: GOSUB 13
    80: GOTO 1370
E8 1270 SUM = N * (N + 1) / 2
16 1280 IF N = 1 THEN DPR(1) = DLTA: BAL(1) = 0: GOTO
    1370
71 1290 : REM TALLY
A3 1300 DSUM = 0
67 1310 FOR I = 1 TO N - 1
4A 1320 DPR(I) = INT (DLTA * (N - I + 1) / SUM)
5A 1330 DSUM = DSUM + DPR(I)
78 1340 BAL(I) = DLTA - DSUM
```

BASICS FOR BUSINESS

```
BB 1350 NEXT
77 1360 DPR(N) = BAL(N - 1):BAL(N) = 0
F3 1370 RETURN
0C 1380 REM ERROR
62 1390 HOME
60 1400 VTAB 10: HTAB 17: INVERSE : PRINT "SORRY:":
    NORMAL
98 1410 VTAB 12: HTAB 1
AF 1420 IF ETYPE = 1 THEN PRINT "SALVAGE VALUE > INI
    TIAL INVESTMENT !"
14 1430 IF ETYPE = 2 THEN PRINT "LIFE SPAN OF INVEST
    MENT > ";MX;" YEARS."
E9 1440 RETURN
A5 1450 REM DISPLAY
E4 1460 FOR I = 1 TO N STEP 10
C7 1470 : REM HEADING
7F 1480 GOSUB 1530
2A 1490 : REM BODY
55 1500 GOSUB 1610
79 1510 NEXT I
E3 1520 RETURN
BF 1530 REM HEADING
52 1540 HOME
BB 1550 PRINT L$
2D 1560 PRINT TAB( 8)"TAX DEPRECIATION SCHEDULE"
C3 1570 PRINT L$
8B 1580 VTAB 5: HTAB 15: PRINT "AMOUNT"; TAB( 31)"AM
   OUNT"
0D 1590 VTAB 6: HTAB 2: PRINT "YEAR"; TAB( 12)"DEPRE
    CIATED"; TAB( 29)"REMAINING"
DD 1600 RETURN
E6 1610 REM BODY
24 1620 ROW = 8
97 1630 FOR J = I TO I + 9
E3 1640 IF J > N THEN 1720
DC 1650 : REM YEAR
65 1660 Y$ = STR$(J): VTAB ROW: HTAB 6 - LEN (Y$):
    PRINT Y$
52 1670 : REM DEPRECIATION
2D 1680 D$ = "$" + STR$(DPR(J)): VTAB ROW: HTAB 23
    - LEN (D$): PRINT D$
26 1690 : REM BALANCE REMAINING
37 1700 B$ = "$" + STR$(BAL(J)): VTAB ROW: HTAB 38
    - LEN (B$): PRINT B$
83 1710 ROW = ROW + 1
82 1720 NEXT J
87 1730 VTAB 19: HTAB 1: PRINT L$
37 1740 IF I + 9 < N THEN VTAB 21: HTAB 14: PRINT "P
    RESS ANY KEY ";: GET S$
F3 1750 RETURN
```

FUTURE WORTH

Program 6-5 computes the future value of an investment. The investment might be for yourself or for a business. We'll illustrate both cases.

First, suppose you buy a money-market certificate from the local savings and loan for \$5,000. It pays 9 percent per annum and matures in ten years. If you enter this data into the Apple, you'll see that your certificate will be worth \$12,298 at maturity, assuming that interest is compounded continuously.

Next, consider the result of buying some prime commercial real estate for \$10,000. If you expect it to appreciate in value 15 percent each year, and you'd like to hold on to it for five years, the Apple calculates that your land will be worth \$20,114 at the end (given yearly compounding of interest).

On the other hand, your acreage might grow in value at only 10 percent per year, or it could boom at a rate of 20 percent. When you're faced with this kind of uncertainty, the power of the Apple can help. Instead of reentering your data, simply tell the computer to use interest rates of 10 percent and 20 percent as well as 15 percent. This will tell you that the range of plausible future worths of your land (based on your projections) is roughly \$16,000 to \$25,000.

Program 6-5. Future Worth

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
78 100 REM FUTURE WORTH
A6 110 REM INITIALIZE
4B 120 GOSUB 270
5A 130 REM ENTER DATA
46 140 GOSUB 700
7A 150 REM EDIT DATA
53 160 GOSUB 840
33 170 REM COMPUTE
F5 180 GOSUB 1290
FE 190 REM DISPLAY
D2 200 GOSUB 1430
A8 210 VTAB 23: HTAB 11: PRINT "ANOTHER RUN (Y/N) ?
    ";BELL$;
57 220 GET S$
```

BASICS FOR BUSINESS

```
DA 230 IF S$ = "Y" OR S$ = "y" THEN 160
D2 240 IF S$ < > "N" AND S$ < > "n" THEN 210
AB 250 HOME : PRINT "BYE-BYE"
96 260 END
B3 270 REM INITIALIZE
55 280 : REM TITLE
57 290 GOSUB 350
B2 300 : REM KEY VALUES
41 310 GOSUB 410
FC 320 : REM INSTRUCTIONS
56 330 GOSUB 590
18 340 RETURN
2E 350 REM TITLE
31 360 PRINT CHR$ (21): TEXT : HOME
75 370 VTAB 12: HTAB 14: PRINT "FUTURE WORTH"
85 380 FOR PAUSE = 1 TO 1500: NEXT
98 390 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
14 400 RETURN
5D 410 REM KEY VALUES
03 420 : REM EFFECTIVE INTEREST RATE & FUTURE WORTH
AB 430 DEF FN EFFRT(F) = (1 + (NOMRT / 100) / F) ^ F
07 440 DEF FN FWTH(I) = PRINCIPAL * ERT(I) ^ N
70 450 : REM DIGITS AFTER DECIMAL
76 460 DA = 2:DOLL$ = "YES"
F3 470 : REM DATA INPUTS
38 480 DATA INITIAL INVESTMENT,INTEREST RATE,YEARS T
    O MATURITY
02 490 FOR I = 1 TO 3
42 500 READ DT$(I)
FE 510 NEXT
60 520 L$ = "": FOR I = 1 TO 39:L$ = L$ + CHR$ (61):
    NEXT
C9 530 : REM COMPOUNDING
4F 540 DATA ANNUAL,QUARTERLY,DAILY,CONTINUOUSLY
03 550 FOR I = 1 TO 4
4C 560 READ FQ$(I)
0B 570 NEXT
25 580 RETURN
91 590 REM INSTRUCTIONS
49 600 HOME
35 610 PRINT "THIS PROGRAM COMPUTES HOW MUCH MONEY A
    N"
F4 620 PRINT "INVESTMENT WILL BE WORTH IN THE FUTURE
    .": PRINT
94 630 PRINT "YOU'LL NEED TO ENTER THREE ITEMS:": PR
    INT
F9 640 FOR I = 1 TO 3
AD 650 VTAB I * 2 + 5: HTAB 11: INVERSE : PRINT I,:
    NORMAL : PRINT CHR$ (32);DT$(I)
9A 660 NEXT
```


BASICS FOR BUSINESS

```
6C 670 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
67 680 GET S$
28 690 RETURN
5A 700 REM ENTER DATA
4C 710 HOME
C1 720 PRINT "PLEASE ENTER YOUR DATA:"
F8 730 FOR I = 1 TO 3
4D 740 VTAB I * 2 + 2: HTAB 1: PRINT DT$(I); " = ?"; :
    COL = POS (0) + 1
78 750 VTAB I * 2 + 2: HTAB COL: PRINT SPC( 20):CLIC
    K = PEEK (Z)
58 760 VTAB I * 2 + 2: HTAB COL: INPUT " ";S$
2C 770 D(I) = VAL (S$)
13 780 IF D(I) < = 0 THEN 750
C9 790 IF I = 1 THEN D$(I) = "$" + S$
6E 800 IF I = 2 THEN D$(I) = S$ + CHR$ (32) + "%"
99 810 IF I = 3 THEN D$(I) = S$
04 820 NEXT
1E 830 RETURN
D8 840 REM EDIT
EA 850 : REM DISPLAY
53 860 GOSUB 900
C1 870 : REM CORRECT
D4 880 GOSUB 1000
2A 890 RETURN
F4 900 REM DISPLAY
4E 910 HOME
03 920 PRINT L$
C9 930 PRINT TAB( 15)"YOUR DATA"
07 940 PRINT L$
FE 950 FOR I = 1 TO 3
14 960 VTAB 2 * I + 3: HTAB 1: INVERSE : PRINT CHR$
    (I + 64);: NORMAL : PRINT CHR$ (32);DT$(I); T
    AB( 22)"= ";D$(I)
0F 970 NEXT
08 980 VTAB 12: HTAB 1: PRINT L$
2B 990 RETURN
5C 1000 REM CORRECT
BC 1010 VTAB 16: HTAB 1: PRINT SPC( 9)
83 1020 VTAB 18: HTAB 1: PRINT SPC( 40)
6A 1030 VTAB 14: HTAB 1: PRINT "CHANGES (Y/N) ? ";:C
    LICK = PEEK (Z)
64 1040 GET S$
4D 1050 A = ASC (S$): IF A > 96 THEN A = A - 32
2E 1060 S$ = CHR$ (A)
46 1070 IF S$ = "N" THEN 1280
43 1080 IF S$ < > "Y" THEN 1030
D6 1090 : REM ITEM
22 1100 VTAB 16: HTAB 1: INVERSE : PRINT "LETTER:":;
    NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
```

BASICS FOR BUSINESS

```
5A 1110 GET S$
43 1120 A = ASC (S$): IF A > 96 THEN A = A - 32
A5 1130 Q = A - 64
B5 1140 IF Q < 1 OR Q > 3 THEN 1100
6D 1150 PRINT CHR$ (A)
4A 1160 VTAB 2 * Q + 3: HTAB 24: INVERSE : PRINT D$(
    Q): NORMAL
56 1170 : REM NEW VALUE
A1 1180 VTAB 18: HTAB 12: PRINT SPC( 20):CLICK = PEE
    K (Z)
44 1190 VTAB 18: HTAB 1: INVERSE : PRINT "NEW VALUE:
    ";: NORMAL
49 1200 INPUT " ";S$
E9 1210 D(Q) = VAL (S$)
EC 1220 IF D(Q) < = 0 THEN 1180
2D 1230 IF Q = 1 THEN D$(Q) = "$" + S$
9C 1240 IF Q = 2 THEN D$(Q) = S$ + CHR$ (32) + "%"
F2 1250 IF Q = 3 THEN D$(Q) = S$
2A 1260 VTAB 2 * Q + 3: HTAB 24: PRINT SPC( 16);: HT
    AB 24: PRINT D$(Q)
6E 1270 GOTO 1010
F5 1280 RETURN
22 1290 REM COMPUTE
3E 1300 HOME
99 1310 VTAB 12: HTAB 16: PRINT "COMPUTING"
CF 1320 PRINCIPAL = D(1):NOMRT = D(2):N = D(3)
69 1330 : REM EFFECTIVE INTEREST RATES
E5 1340 ERT(1) = FN EFFRT(1)
03 1350 ERT(2) = FN EFFRT(4)
F1 1360 ERT(3) = FN EFFRT(365)
E0 1370 ERT(4) = EXP (NOMRT / 100)
56 1380 : REM FUTURE WORTHS
C3 1390 FOR I = 1 TO 4
74 1400 FW(I) = FN FWTH(I)
AD 1410 NEXT
E1 1420 RETURN
9D 1430 REM DISPLAY
50 1440 HOME
B9 1450 PRINT L$
97 1460 PRINT TAB( 14)"FUTURE WORTH"
C1 1470 PRINT L$
B1 1480 FOR I = 1 TO 3
6D 1490 VTAB I + 4: HTAB 1: PRINT DT$(I); TAB( 20)"=
    ";D$(I)
AB 1500 NEXT
35 1510 VTAB 9: HTAB 6: INVERSE : PRINT "FREQUENCY O
    F";: HTAB 29: PRINT "FUTURE"
FE 1520 VTAB 10: HTAB 6: PRINT "COMPOUNDING ";: HTAB
    30: PRINT "WORTH": NORMAL
96 1530 HT = 34
```

BASICS FOR BUSINESS

```
B3 1540 FOR I = 1 TO 4
5F 1550 VTAB 2 * I + 10: HTAB 6: PRINT FQ$(I);:NR =
    FW(I): GOSUB 9000
C3 1560 NEXT
B4 1570 VTAB 21: HTAB 1: PRINT L$
FB 1580 RETURN
57 9000 REM "PRINT USING" SUBROUTINE
08 9010 ZR$ = "":ZS$ = "":ZD$ = "":ZZ$ = "0000000000"
4A 9020 N$ = STR$ (NR)
B9 9030 IF DOLL$ = "YES" THEN ZD$ = "$"
D6 9040 IF NR < 0 THEN ZS$ = "-"
4A 9050 LET ZN = ABS (NR) + 5 * 10 ^ - (DA + 1)
2F 9060 LET ZL = INT (ZN):ZR = INT ((ZN - ZL) * 10 ^
    DA)
AC 9070 IF DA > 0 THEN ZR$ = "." + RIGHT$ (ZZ$ + STR
    $ (ZR),DA)
49 9080 ZT$ = " " + STR$ (ZL)
72 9090 IF MID$ (ZT$, LEN (ZT$) - 3,1) < > "E" THEN
    N$ = ZS$ + ZD$ + STR$ (ZL) + ZR$
61 9100 HTAB (HT + 1 - LEN (N$)): PRINT N$
DF 9110 RETURN
```



CHAPTER 7

Science and Statistics

7

Science and Statistics

These seven programs use the Apple II's tremendous number-crunching and curve-plotting capabilities. The first three programs deal with statistics, the middle two with solving equations and plotting curves, and the last two with some basic chemistry.

Scatter Diagram. This program plots observations of two variables on your screen in high-resolution mode, draws a line of best fit through them, and computes a simple correlation coefficient.

Super Curve-Fitter. Performs multiple linear regression analysis on a set of data. You can edit your entries, transform your data, and choose which X's to include in your equation. And you can do this repeatedly without having to reenter your data each time.

T-Test. Tallies t-critical values that are needed to test hypotheses on regression coefficients from the "Super Curve-Fitter" program.

Simultaneous Equation Solver. Solves a set of simultaneous equations for each unknown.

Curve Plotter. Plots any function you enter on the high-resolution screen. Everything from straight lines and parabolas to sine curves and rectangular hyperbolas are permissible. The Y- and X-axes are automatically numbered, but you can change the scaling to suit your preferences.

Chemistry Basics. Enables you to review and analyze a wealth of intriguing information on the earth's 103 basic elements. Data items include atomic number, atomic weight, boiling and melting points, density, and date of discovery. You can display elements individually or by family, and you can sort them a number of different ways.

Chemistry Basics Database. Creates an electronic database for use in the preceding program.

Technical note. Three of the programs use formatted numerical output—Super Curve-Fitter, T-Test, and Simultaneous Equation Solver. In each case, a BASIC subroutine (lines 9000–9110) rounds numbers and lines them up on a decimal point.

Here's a way to enter these lines just once instead of three times. First, enter the subroutine and save it on a disk. Then load the subroutine before you type in a program. The lines will appear in memory, saving you the trouble of reentering them.

SCATTER DIAGRAM

You often read or hear comments in the media such as, "Interest rates are up and housing starts down," or "Lack of rainfall in the farm belt has devastated crops." These remarks have one thing in common: They imply a cause-and-effect relationship between two variables. High interest rates, for example, cause the construction business to slump.

Whenever you want to investigate a possible cause-effect relationship, you can use this program to plot the two variables against each other.

Suppose you want to explain the volume of immigration to the United States from 1889 to 1918, with the basic data in Table 7-1 (see next page). Concentrating on the variables Number of Immigrants and GNP (gross national product, a measure of the total goods and services produced in a country over time), enter the data into the computer as prompted.

The Apple responds with what statisticians call a scatter diagram, or a plot of observations on two variables (see Figure 7-1). The Apple draws a line of best fit through the data and displays a simple correlation coefficient.

Figure 7-1. Scatter Diagram

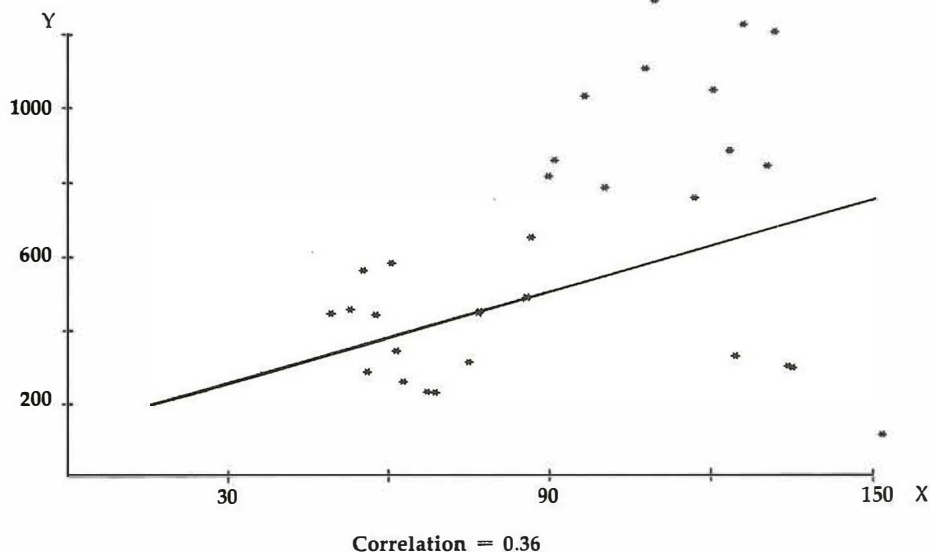


Table 7-1. Immigration Data

Year	Number of Immigrants (thousands)	GNP (in billions of dollars)	Wartime Variable (0=peace, 1=war)
1889	444	49.1	0
1890	455	52.7	0
1891	560	55.1	0
1892	580	60.4	0
1893	440	57.5	0
1894	286	55.9	0
1895	259	62.6	0
1896	343	61.3	0
1897	231	67.1	0
1898	229	68.6	0
1899	312	74.8	0
1900	449	76.9	0
1901	488	85.7	0
1902	649	86.5	0
1903	857	90.8	0
1904	813	89.7	0
1905	1026	96.3	0
1906	1101	107.5	0
1907	1285	109.2	0
1908	783	100.2	0
1909	752	116.8	0
1910	1042	120.1	0
1911	879	123.2	0
1912	838	130.2	0
1913	1198	131.4	0
1914	1218	125.6	0
1915	327	124.5	1
1916	299	134.3	1
1917	295	135.2	1
1918	111	151.8	1

Note: GNP (Gross National Product) is given in constant 1958 dollars.

This coefficient measures the strength of the linear (straight-line) association between two variables. It ranges in value from -1 to $+1$, with a value close to either extreme indicating a strong relationship, and a value close to 0 indicating a weak one.

In the example, the positive sign of the correlation coefficient indicates that immigration increases when income (specifically, GNP) rises, and the magnitude 0.36 means that the association between the two terms is weak rather than strong.

Finally, scatter diagrams are a useful prelude to multiple linear regression analysis, covered in the next section. They give easy-to-understand information on the relationship between two variables (linear or curved) and on the strength of the association (weak or strong).

The program accepts data only in the range 0 to 99999 , inclusive. But don't worry if one or more of your observations falls outside these limits. Instead, scale your data by either adding or multiplying each observation by a constant. For the set of data (-1 , 2 , and 3), for example, add 1 to each observation to get (0 , 3 , and 4). The value of the simple correlation coefficient does not change when you do this.

The Apple draws numbers and letters on the screen using shapes from a binary file. This file is created by Program 7-1A, which you should enter and run first and only once. A shape file will be created on your disk for Program 7-1B to read. Then, whenever you want to use "Scatter Diagram," just run Program 7-1B. You don't have to run Program 7-1A again.

Program 7-1A. Scatter Diagram Shape File Generator

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
0F 100 REM SHAPES FOR SCATTER DIAGRAM
F6 110 : REM DIRECTORY
62 120 DATA 25,0,52,0,66,0,77,0,91,0,100,0,112,0,125
    ,0,136,0,149,0
63 130 DATA 162,0,173,0,187,0,199,0,202,0,215,0,224,
    0,235,0,246,0,2,1
08 140 DATA 10,1,22,1,31,1,44,1,56,1,89,1
05 150 : REM X & Y
EB 160 DATA 12,12,60,27,51,14,22,23,46,9,33,28,7,0
45 170 DATA 5,40,32,31,27,54,49,49,54,6,0
57 180 : REM 0 TO 9, & DECIMAL
```

SCIENCE AND STATISTICS

```
A4 190 DATA 12,37,28,63,23,54,46,55,14,45,12,36,4,0
47 200 DATA 36,60,42,54,54,46,63,7,0
19 210 DATA 45,32,28,63,23,22,17,23,46,45,37,0
B2 220 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
09 230 DATA 33,36,23,23,23,46,45,61,54,6,0
80 240 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
C6 250 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
4F 260 DATA 30,54,36,5,40,40,32,63,63,7,0
F6 270 DATA 45,50,30,63,7,32,12,28,36,41,45,50,6,0
1A 280 DATA 39,35,12,45,21,54,47,54,51,59,63,0
5E 290 DATA 18,50,0
C9 300 : REM S,c,a,t,e,r,D,i,g,m
AB 310 DATA 39,35,12,45,21,30,42,50,30,63,28,7,0
05 320 DATA 40,61,63,23,54,14,45,37,0
49 330 DATA 3,40,45,50,54,63,63,32,41,45,0
C6 340 DATA 40,63,36,54,47,54,54,41,5,32,0
F6 350 DATA 40,21,62,63,39,12,23,54,14,45,37,0
38 360 DATA 40,61,63,51,61,54,54,0
3D 370 DATA 9,54,30,63,39,36,36,44,45,21,54,0
9B 380 DATA 60,12,48,50,54,62,45,4,0
94 390 DATA 40,21,54,54,59,39,9,56,39,35,12,5,0
1D 400 DATA 12,53,54,62,3,32,36,59,54,54,5,0
EC 410 : REM BOX
9E 420 DATA 36,36,45,53,54,54,54,62,36,36,36,60,54,5
    4,54,62,63,39,36,36
17 430 DATA 36,44,53,55,53,55,53,53,62,39,37,63,0
33 440 : REM CIRCLE
C3 450 DATA 45,60,60,62,60,50,53,47,46,44,38,45,0
B0 460 FOR I = 16384 TO 16741
AE 470 READ V
96 480 POKE I,V
0E 490 NEXT
CA 500 PRINT CHR$(4);"BSAVE SR.SHAPE,A16384,L358"
8F 510 END
```

Program 7-1B. Scatter Diagram

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
EE 100 LOMEM: 17000
44 110 REM SCATTER DIAGRAM
4D 120 : REM INITIALIZE
4B 130 GOSUB 260
B0 140 : REM ENTER DATA
53 150 GOSUB 660
56 160 : REM COMPUTE
D7 170 GOSUB 1410
69 180 : REM DRAW GRAPH
D6 190 GOSUB 2110
```

SCIENCE AND STATISTICS

```
75 200 VTAB 24: HTAB 10: PRINT "ANOTHER PLOT (Y/N) ?  
";BELL$;  
55 210 GET S$  
D7 220 IF S$ = "Y" OR S$ = "y" THEN 150  
C8 230 IF S$ < > "N" AND S$ < > "n" THEN 200  
E8 240 TEXT : HOME : PRINT "BYE-BYE"  
94 250 END  
B1 260 REM INITIALIZE  
53 270 : REM TITLE  
53 280 GOSUB 340  
0A 290 : REM INSTRUCTIONS  
3D 300 GOSUB 400  
B4 310 : REM KEY VALUES  
42 320 GOSUB 500  
19 330 RETURN  
2C 340 REM TITLE  
2F 350 PRINT CHR$ (21): TEXT : HOME  
CF 360 VTAB 12: HTAB 12: PRINT "SCATTER DIAGRAM"  
83 370 FOR PAUSE = 1 TO 1500: NEXT  
96 380 BELL$ = CHR$ (7):Z = - 16336: REM CLICK  
25 390 RETURN  
7E 400 REM INSTRUCTIONS  
49 410 HOME  
B0 420 PRINT "SCATTER DIAGRAM DRAWS A LINE OF BEST F  
IT";  
9C 430 PRINT "THROUGH A SET OF OBSERVATIONS PLOTTED"  
31 440 PRINT "ON AN X-Y GRID.": PRINT  
26 450 PRINT "PLEASE MAKE SURE THAT ALL YOUR OBSERVA  
-"  
90 460 PRINT "TIONS ARE BETWEEN 0 AND 99999."  
6A 470 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";  
65 480 GET S$  
26 490 RETURN  
5C 500 REM KEY VALUES  
3F 510 HOME : VTAB 12: HTAB 16: PRINT "READING"  
A2 520 : REM MAX NUMBER OF OBSERVATIONS  
18 530 DATA 100  
7E 540 READ NX  
A7 550 DIM D(NX,2),LTR(14)  
45 560 : REM SYMBOLS  
B6 570 V$(1) = "Y":V$(2) = "X"  
6C 580 L$ = "": FOR I = 1 TO 39:L$ = L$ + CHR$ (61):  
NEXT  
B9 590 : REM SHAPE #'S FOR TITLE  
7E 600 DATA 14,15,16,17,17,18,19,20,21,16,22,19,16,2  
3  
50 610 FOR I = 1 TO 14: READ LTR(I): NEXT  
F2 620 : REM SHAPES  
FD 630 PRINT CHR$ (4);"BLOOD SR.SHAPE"  
99 640 POKE 233,64: POKE 232,0
```


SCIENCE AND STATISTICS

```
28 650 RETURN
65 660 REM ENTER DATA
82 670 : REM ON Y
58 680 GOSUB 740
84 690 : REM ON X
57 700 GOSUB 890
98 710 : REM EDIT
5C 720 GOSUB 990
1D 730 RETURN
07 740 REM Y
64 750 TEXT : HOME
CB 760 PRINT "PLEASE ENTER DATA ON Y. HIT ";: INVER
    SE : PRINT "RETURN": NORMAL
6C 770 PRINT "WHEN YOU'RE DONE."
4E 780 N = NX
AB 790 FOR J = 1 TO NX
6C 800 VTB 5: HTAB 9: PRINT SPC( 20)
EF 810 VTB 5: HTAB 1: PRINT "Y(";J;")"; TAB( 7);"="
    ;
ED 820 INPUT " ";V$
12 830 IF V$ = "" THEN N = J - 1:J = NX
33 840 IF V$ < > "" THEN D(J,1) = VAL (V$)
0A 850 NEXT
E2 860 : REM DEGREES OF FREEDOM
04 870 IF N < 3 THEN VTB 23: HTAB 4: PRINT "I NEED
    AT LEAST 3 OBSERVATIONS !";BELL$;; GOTO 780
28 880 RETURN
D1 890 REM X
4C 900 HOME
AC 910 PRINT "PLEASE ENTER DATA ON X."
12 920 FOR J = 1 TO N
F2 930 VTB 4: HTAB 9: PRINT SPC( 20)
56 940 VTB 4: HTAB 1: PRINT "X(";J;")"; TAB( 7);"="
    ;
F4 950 INPUT " ";V$
9A 960 D(J,2) = VAL (V$)
0F 970 NEXT
29 980 RETURN
8A 990 REM EDIT DATA
79 1000 FOR I = 1 TO 2
49 1010 FOR J = 1 TO N STEP 10
6B 1020 : REM DISPLAY
77 1030 GOSUB 1080
E6 1040 : REM EDIT
4F 1050 GOSUB 1210
05 1060 NEXT J,I
ED 1070 RETURN
14 1080 REM DISPLAY DATA
5C 1090 HOME
9F 1100 PRINT L$
```

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```
A5 1110 A$ = CHR$ (32)
D9 1120 IF J > 10 THEN A$ = " MORE "
F2 1130 PRINT "THESE ARE";A$;"VALUES OF ";V$(I);": "
9B 1140 PRINT L$: PRINT
82 1150 R = 0
AC 1160 FOR L = J TO J + 9
61 1170 IF L <= N THEN R = R + 1: INVERSE : PRINT C
    HR$ (R + 64);: NORMAL : PRINT " #";L; TAB( 7
    )"=" ;D(L,I)
90 1180 NEXT L
BD 1190 VTAB 16: HTAB 1: PRINT L$
D5 1200 RETURN
CE 1210 REM CORRECT DATA
BB 1220 VTAB 21: HTAB 1: PRINT SPC( 9)
C6 1230 VTAB 23: HTAB 1: PRINT SPC( 39)
DF 1240 VTAB 19: HTAB 1: PRINT "CORRECTIONS (Y/N) ?
    ";:CLICK = PEEK (Z)
6C 1250 GET S$
9C 1260 IF S$ = "N" OR S$ = "n" THEN 1400
D1 1270 IF S$ < > "Y" AND S$ < > "y" THEN 1240
3B 1280 VTAB 21: HTAB 1: INVERSE : PRINT "LETTER:";:
    NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
7C 1290 GET S$
3F 1300 A = ASC (S$): IF A > 96 THEN A = A - 32
A1 1310 Q = A - 64
1E 1320 IF Q < 1 OR Q > R THEN 1280
69 1330 PRINT CHR$ (A)
72 1340 VTAB (A - 60): HTAB 9: INVERSE : PRINT D(J +
    Q - 1,I)
2C 1350 VTAB 23: HTAB 1: INVERSE : PRINT "NEW VALUE:
    ";: NORMAL : PRINT CHR$ (32);
63 1360 INPUT " ";S$
89 1370 D(J + Q - 1,I) = VAL (S$)
B3 1380 VTAB (A - 60): HTAB 9: PRINT SPC( 20);: HTAB
    9: PRINT D(J + Q - 1,I)
80 1390 GOTO 1220
D9 1400 RETURN
06 1410 REM COMPUTE
89 1420 HOME : VTAB 12: HTAB 16: PRINT "COMPUTING"
6D 1430 : REM SCALES
93 1440 GOSUB 1480
63 1450 : REM TREND LINE
8F 1460 GOSUB 1940
F5 1470 RETURN
AC 1480 REM SCALES
CB 1490 : REM # OF Y & X AXIS INCREMENTS
12 1500 N(1) = 5:N(2) = 4
87 1510 FOR I = 1 TO 2
84 1520 : REM HIGH & LOW VALUES
59 1530 GOSUB 1600
```

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```
AE 1540 : REM TIC-MARK DELTA
BD 1550 GOSUB 1750
4C 1560 : REM AXIS NUMBERS
91 1570 GOSUB 1840
95 1580 NEXT I
FF 1590 RETURN
93 1600 REM HIGH & LOW
9E 1610 HIGH = - 1E10:LOW = 1E10
CF 1620 FOR J = 1 TO N
AB 1630 IF D(J,I) > HIGH THEN HIGH = D(J,I)
58 1640 IF D(J,I) < LOW THEN LOW = D(J,I)
8C 1650 NEXT J
77 1660 IF LOW < 0 OR HIGH > 99999 THEN ETYPE = 1: G
    OSUB 1680: STOP
F9 1670 RETURN
12 1680 REM ERROR
48 1690 E$(1) = "DATA OUTSIDE THE RANGE 0 TO 99999"
6C 1700 E$(2) = "DELTA BETWEEN TIC MARKS < 0.01"
4A 1710 HOME
09 1720 VTAB 5: HTAB 17: INVERSE : PRINT "SORRY:": N
    ORMAL
0B 1730 VTAB 7: HTAB 1: PRINT E$(ETYPE)
EF 1740 RETURN
44 1750 REM TIC-MARK DELTA
9C 1760 DL = (HIGH - LOW) / N(I)
64 1770 FOR J = 1 TO 6
1C 1780 M = 10 ^ (J - 3)
B3 1790 IF DL >= M THEN DL = M * INT ((1 / M) * DL
    + 0.5)
7C 1800 NEXT J
75 1810 IF DL < 0.01 THEN ETYPE = 2: GOSUB 1680: STO
    P
07 1820 DL(I) = DL
ED 1830 RETURN
0D 1840 REM AXIS NUMBERS
55 1850 BREAK$(I) = "ON"
E7 1860 E = INT (LOW / DL + .1) * DL
59 1870 IF E = 0 THEN E = E + DL
02 1880 IF E = DL THEN BREAK$(I) = "OFF"
5B 1890 FOR J = 1 TO N(I) + 1
51 1900 IF I = 1 THEN Y(J) = E + DL * (J - 1)
36 1910 IF I = 2 THEN X(J) = E + DL * (J - 1)
86 1920 NEXT J
EF 1930 RETURN
9D 1940 REM TREND LINE
35 1950 : REM SUMS
F7 1960 SX = 0:SY = 0:XQ = 0:YQ = 0:CP = 0
69 1970 FOR I = 1 TO N
7B 1980 SX = SX + D(I,2)
60 1990 SY = SY + D(I,1)
```

SCIENCE AND STATISTICS

```

79 2000 XQ = XQ + D(I,2) ^ 2
CD 2010 YQ = YQ + D(I,1) ^ 2
BD 2020 CP = CP + D(I,1) * D(I,2)
AE 2030 NEXT
7B 2040 : REM EQUATION
31 2050 SLOPE = (N * CP - SX * SY) / (N * XQ - SX *
      SX)
AI 2060 YI = (SY - SLOPE * SX) / N
A9 2070 : REM R
1D 2080 R = (N * CP - SX * SY) / SQR ((N * XQ - SX *
      SX) * (N * YQ - SY * SY))
D4 2090 R = INT (R * 100 + .5) / 100
D4 2100 RETURN
7F 2110 REM GRAPH
35 2120 HOME : HGR : HCOLOR= 3: ROT= 0: SCALE= 1
8B 2130 : REM DRAW AXES
78 2140 GOSUB 2260
AC 2150 : REM DRAW GRID
5B 2160 GOSUB 2400
54 2170 : REM LABEL AXES
90 2180 GOSUB 2460
5F 2190 : REM TITLE
62 2200 GOSUB 2820
98 2210 : REM POINTS
8E 2220 GOSUB 2960
94 2230 : REM LINE
8C 2240 GOSUB 3090
EA 2250 RETURN
66 2260 REM AXES
B4 2270 : REM Y
13 2280 HPLLOT 50,34 TO 50,146
CC 2290 FOR I = 34 TO 119 STEP 17
E6 2300 HPLLOT 49,I TO 51,I
AC 2310 NEXT
C1 2320 IF BREAK$(1) = "ON" THEN HCOLOR= 0: HPLLOT 50
      ,126 TO 50,131: HCOLOR= 3: HPLLOT 48,128 TO 5
      2,124: HPLLOT 48,133 TO 52,129
A5 2330 : REM X
1F 2340 HPLLOT 40,136 TO 250,136
A6 2350 FOR I = 90 TO 250 STEP 40
F6 2360 HPLLOT I,135 TO I,137
C4 2370 NEXT
CB 2380 IF BREAK$(2) = "ON" THEN HCOLOR= 0: HPLLOT 67
      ,136 TO 73,136: HCOLOR= 3: HPLLOT 65,138 TO 6
      9,134: HPLLOT 71,138 TO 75,134
FC 2390 RETURN
1B 2400 REM GRID
FB 2410 FOR X = 70 TO 250 STEP 20
BC 2420 FOR Y = 34 TO 119 STEP 17
3A 2430 HPLLOT X,Y

```

SCIENCE AND STATISTICS

```
51 2440 NEXT Y,X
EE 2450 RETURN
93 2460 REM LABEL AXES
BB 2470 : REM Y
C6 2480 Y = 136:DL = DL(1)
E6 2490 FOR I = 1 TO 6
C4 2500 NR = Y(I): GOSUB 2630
54 2510 Y = Y - 17:X = 48 - L * 6
74 2520 GOSUB 2730
82 2530 NEXT I
AD 2540 : REM X
3D 2550 Y = 145:DL = DL(2)
95 2560 FOR I = 1 TO 5 STEP 2
0D 2570 X = I * 40 + 50
64 2580 NR = X(I): GOSUB 2630
8B 2590 X = X - (L - 1) * 6 / 2
6E 2600 GOSUB 2730
7C 2610 NEXT I
E6 2620 RETURN
E9 2630 REM FORMAT NUMBER FOR OUTPUT
CC 2640 ZR$ = "":ZZ$ = "000":N$ = STR$(NR):DA = 0
26 2650 IF (DL >= 0.1 AND DL < 1) THEN DA = 1
A1 2660 IF (DL < 0.1) THEN DA = 2
DF 2670 ZN = NR + 5 * 10 ^ - (DA + 1)
A7 2680 ZL = INT(ZN):ZR = INT((ZN - ZL) * 10 ^ DA)
B9 2690 IF DA > 0 THEN ZR$ = "." + RIGHT$(ZZ$ + STR$(ZR),DA)
32 2700 N$ = STR$(ZL) + ZR$
24 2710 L = LEN(N$)
EB 2720 RETURN
DB 2730 REM DRAW NUMBER
BA 2740 FOR J = 1 TO L
60 2750 HCOLOR= 3: DRAW 24 AT X,Y
07 2760 A = ASC ( MID$(N$,J,1))
E2 2770 S = A - 45
2E 2780 IF A = 46 THEN S = 13
5E 2790 HCOLOR= 0: DRAW S AT X,Y:X = X + 6
7D 2800 NEXT J
E6 2810 RETURN
0D 2820 REM TITLE
07 2830 X = 95
21 2840 FOR I = 1 TO 14
51 2850 HCOLOR= 3: DRAW 24 AT X,7
CB 2860 IF I = 8 THEN X = X + 7: DRAW 24 AT X,7: REM
MIDDLE SPACE
15 2870 HCOLOR= 0: DRAW LTR(I) AT X,7
95 2880 X = X + 7
D6 2890 NEXT
92 2900 : REM BOX
DB 2910 HCOLOR= 3
```

```

E5 2920 HPLLOT 0,0 TO 279,0: HPLLOT TO 279,159: HPLLOT
    TO 0,159: HPLLOT TO 0,0
63 2930 : REM Y & X
1D 2940 DRAW 1 AT 260,134: DRAW 2 AT 50,20
F8 2950 RETURN
CA 2960 REM POINTS
C1 2970 : REM SCALING FACTORS FOR Y & X
8C 2980 B = 85 / (Y(1) - Y(6)):A = 119 - B * Y(1)
94 2990 DEF FN Y(V) = A + B * V
A8 3000 D = 160 / (X(5) - X(1)):C = 250 - D * X(5)
E3 3010 DEF FN X(V) = C + D * V
99 3020 : REM POINTS
49 3030 FOR I = 1 TO N
8C 3040 Y = FN Y(D(I,1)): IF Y < 3 THEN Y = 3
18 3050 X = FN X(D(I,2)): IF X > 276 THEN X = 276
DD 3060 DRAW 25 AT X,Y
BF 3070 NEXT
F3 3080 RETURN
BF 3090 REM LINE
7B 3100 HX = 0:HY = 0
A4 3110 FOR I = X(1) - DL * 3 / 4 TO X(5) + DL / 4 S
    TEP DL / 4
2F 3120 X = FN X(I):Y = FN Y(YI + SLOPE * I)
11 3130 IF NOT (X > 50 AND X < 270) OR NOT (Y > 10 A
    ND Y < 140) THEN 3170
9B 3140 IF HX < > 0 THEN HPLLOT HX,HY TO X,Y
9D 3150 IF HX = 0 THEN HPLLOT X,Y
3A 3160 HX = X:HY = Y
C1 3170 NEXT
0A 3180 VTAB 22: HTAB 12: PRINT "CORRELATION = ";: I
    NVERSE : PRINT R: NORMAL
F9 3190 RETURN

```


SUPER CURVE-FITTER

Continuing with the previous example, we might like to estimate how much immigration will increase when the GNP increases and, at the same time, try to compute what effect World War I had on the flow of citizens from foreign nations into America. "Super Curve-Fitter," a multiple linear regression analysis routine with data transformations, helps make these estimates easy.

First, type in data for the three variables, Number of Immigrants, GNP, and Wartime Variable (Table 7-1). The yearly volume of immigration is called the dependent variable in the equation, and is denoted by the letter Y . Enter 444 for the year 1889, 455 for 1890, and so on. Then enter observations on the two explanatory variables, GNP and Wartime, denoted by X_1 and X_2 , respectively.

After you've entered the observations, the Apple asks which X 's you'd like to use in the current regression run. Enter both X_1 and X_2 . Later, the Apple will return to this same spot in the program, and you can make a different selection. You can estimate several regression equations in any one curve-fitting exercise without having to enter the same data all over again.

Next, the Apple asks if you'd like to transform the data—if you'd like to take logs or reciprocals. You don't in this case, but see the technical note below if you ever do.

Finally, the Apple estimates the regression equation and displays the results (Figure 7-2).

The estimated values 9.779 and -901.862 are called regression coefficients. They measure the impact on Y of a one-unit change in the value of an explanatory variable, with all other X 's held constant. Since X_1 is the variable on GNP, the 9.779 means that each \$1 billion increase in real income in the United States induced roughly 9.8 thousand more immigrants to enter America per year.

Similarly, -901.862 means that the war induced roughly 901,000 would-be immigrants to stay home. In short, then, immigration increased when the U.S. economy was healthy and decreased when the country was at war.

Figure 7-2. Regression Equation

N = 30 Dependent Variable: Y

Term	Estimated Value	t-Ratio
Constant	-174.488	-1.366
X1	9.779	6.951
X2	-901.862	-7.239

SUMMARY VALUES

Variation in Y	Sums of Squares	Degrees of Freedom
Total	3374698.313	29
Regression	2379656.477	2
Residual	995041.836	27

R-Squared	=	0.705	R-Bar Squared =	0.683
F-Statistic	=	32.285		
Standard Error of the Estimate	=	191.972		
Durbin-Watson Statistic	=	0.798		

A *t-ratio* is the value of a term divided by its estimated standard error. A *t-ratio* of 2 or more means that an explanatory variable is statistically significant in explaining changes in Y, as are GNP and Wartime in the example (see the *t-test* program for details).

The total variation in the dependent about its mean is called the *total sum of the squares*. It equals the *regression sum of squares* (the variation in Y explained by the regression equation) plus the *residual sum of squares* (the unexplained variation in Y).

The next four figures are *goodness-of-fit* statistics. The *coefficient of determination*, or *R-squared*, is the extent to which variations in the dependent variable can be explained by the regression equation. In the example, roughly 70 percent of the fluctuation in yearly immigration is explained by changes in real GNP and by World War I.

R-bar squared is the *R-squared* statistic adjusted for degrees of freedom, and the *F-statistic* measures the power of the regression equation in explaining Y. Generally, an F value of 4 or more means that the X's in total explain Y well. The *standard error of the estimate* is, roughly speaking, the average error made in predicting immigration based on X1 and X2. That

is, the predictions are, on average, off by roughly 192,000 persons per year.

Finally, the *Durbin-Watson statistic* is used in testing for something called *first-order serial correlation*, or for linear association between successive *regression residuals* (a residual is the observed minus the predicted value of Y).

Technical note. Super Curve-Fitter offers three data transformations: logs, reciprocals, and lags.

Logs. Suppose the regression equation is in the form $Y = a * X^b$, where a and b are population parameters to estimate. This equation is nonlinear, and Curve-Fitter can't work with it in this form. But taking logs of both sides of the equation gives $\log(Y) = \log(a) + b * \log(X)$

which is a linear equation. This is no problem for Curve-Fitter. Therefore, to estimate an equation in power-function form, ask Curve-Fitter to tally $\log(Y)$ and $\log(X)$.

Reciprocals. For equations in the form $Y = a + b * (1/X)$, there's no need to compute $1/X$ manually. Instead, enter observations on X and then ask Curve-Fitter to compute the reciprocal.

Lags. In the regression exercise we assumed that the volume of immigration in any year depended upon U.S. income in that same year. But perhaps it really depended upon income in the previous year.

To test this idea, ask Curve-Fitter to lag the income variable (X1) by one year. It adjusts the set of data accordingly and estimates the equation anew.

Program 7-2. Super Curve-Fitter

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

3C 100 REM SUPER CURVE-FITTER
4B 110 : REM INITIALIZE
3E 120 GOSUB 300
4E 130 : REM ENTER DATA
56 140 GOSUB 780
1F 150 : REM ASK WHICH X'S TO USE
E5 160 GOSUB 1640
59 170 : REM TRANSFORM DATA
DC 180 GOSUB 2130
79 190 IF ETYPE < > 0 THEN GOSUB 1990: GOTO 160
4B 200 : REM COMPUTE
CA 210 GOSUB 3210
    
```

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```

81 220 : REM SHOW RESULTS
E5 230 GOSUB 4360
CE 240 VTAB 24: HTAB 7: PRINT "ANOTHER REGRESSION (Y
    /N) ? ";BELL$;
5D 250 GET S$
E0 260 IF S$ = "Y" OR S$ = "y" THEN 160
F0 270 IF S$ < > "N" AND S$ < > "n" THEN 240
B1 280 HOME : PRINT "BYE-BYE"
9C 290 END
A6 300 REM INITIALIZE
48 310 : REM TITLE
50 320 GOSUB 380
88 330 : REM KEY VALUES
4D 340 GOSUB 440
03 350 : REM INSTRUCTIONS
5B 360 GOSUB 680
21 370 RETURN
34 380 REM TITLE
37 390 PRINT CHR$ (21): TEXT : HOME
86 400 VTAB 12: HTAB 11: PRINT "SUPER CURVE-FITTER"
78 410 FOR PAUSE = 1 TO 1500: NEXT
8B 420 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
1A 430 RETURN
63 440 REM KEY VALUES
0D 450 : REM MAX NUMBER OF OBSERVATIONS & X'S
F1 460 DATA 50,6
D2 470 READ NX,KX
6A 480 M = KX + 1
05 490 DIM B(M),X(NX,M),XT(NX,M),E(NX),V$(M),CV$(M),
    CV(M),CP(M,2 $ M),XY(M)
39 500 : REM SYMBOLS
72 510 V$(0) = "Y"
43 520 FOR I = 1 TO KX
F6 530 V$(I) = "X" + STR$ (I)
05 540 NEXT
66 550 L$ = "": FOR I = 1 TO 39:L$ = L$ + CHR$ (61):
    NEXT
A9 560 : REM DECIMAL PLACES
CE 570 DA = 3
3F 580 : REM DATA TRANSFORMATIONS
43 590 DATA LOGS (NATURAL), RECIPROCALs, LAGS, NONE
F9 600 FOR I = 1 TO 4
45 610 READ DT$(I)
02 620 NEXT
7E 630 : REM ERRORS
DB 640 E$(1) = "YOU HAVE LESS THAN 1 DEGREE OF FREED
    OM"
07 650 E$(2) = "I CAN'T TAKE THE LOG OF NUMBERS <= 0
    "
0E 660 E$(3) = "I CAN'T TAKE THE RECIPROCAL OF ZERO"

```

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```
24 670 RETURN
90 680 REM INSTRUCTIONS
5B 690 HOME
D1 700 PRINT "SUPER CURVE-FITTER ESTIMATES A MULTIPL
    E"
6E 710 PRINT "LINEAR REGRESSION EQUATION."
03 720 VTAB 4: HTAB 1: PRINT "UP TO ";: INVERSE : PR
    INT NX;: NORMAL : PRINT " OBSERVATIONS ON ";:
    INVERSE : PRINT KX;: NORMAL : PRINT " EXPLAN
    ATORY"
A9 730 VTAB 5: HTAB 1: PRINT "VARIABLES (X'S) ARE AL
    LOWED."
71 740 VTAB 7: HTAB 1: PRINT "CHANGE LINE 460 FOR BI
    GGER LIMITS."
69 750 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
64 760 GET S$
25 770 RETURN
6A 780 REM ENTER DATA
95 790 : REM ENTER DATA ON Y
56 800 GOSUB 880
B8 810 : REM ENTER # OF X'S
D4 820 GOSUB 1030
01 830 : REM ENTER DATA ON X'S
D2 840 GOSUB 1110
A4 850 : REM EDIT
DC 860 GOSUB 1220
26 870 RETURN
10 880 REM Y
5D 890 HOME
D3 900 PRINT "PLEASE ENTER DATA ON YOUR DEPENDENT"
EB 910 PRINT "VARIABLE. HIT ";: INVERSE : PRINT "RE
    TURN";: NORMAL : PRINT " WHEN YOU'RE DONE."
7D 920 NT = NX
A1 930 FOR J = 1 TO NX
75 940 VTAB 5: HTAB 9: PRINT SPC( 20)
F8 950 VTAB 5: HTAB 1: PRINT "Y(";J;")"; TAB( 7);"="
    ;
F6 960 INPUT " ";V$
AB 970 IF V$ = "" THEN NT = J - 1;J = NX
3E 980 IF V$ < > "" THEN X(J,0) = VAL (V$)
78 990 NEXT J
4F 1000 : REM DEGREES OF FREEDOM
FA 1010 IF NT < 3 THEN VTAB 23: HTAB 4: PRINT "I NEE
    D AT LEAST 3 OBSERVATIONS !";BELL$;: GOTO 92
    0
D9 1020 RETURN
67 1030 REM NUMBER OF X'S
48 1040 HOME
92 1050 VTAB 1: HTAB 28: PRINT SPC( 10);BELL$
```


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```
AA 1060 VTAB 1: HTAB 1: INPUT "HOW MANY X'S DO YOU H
    AVE ? ";K$
59 1070 KT = INT ( VAL (K$))
1A 1080 IF KT < 1 THEN 1050
AE 1090 IF KT > KX THEN VTAB 23: HTAB 10: PRINT "ONL
    Y ";KX;" ARE ALLOWED !": GOTO 1050
03 1100 RETURN
76 1110 REM X'S
AF 1120 FOR I = 1 TO KT
46 1130 HOME
7C 1140 PRINT "PLEASE ENTER OBSERVATIONS ON ";V$(I);
    " ";BELL$
6C 1150 FOR J = 1 TO NT
06 1160 VTAB 3: HTAB 11: PRINT SPC( 20)
0F 1170 VTAB 3: HTAB 1: INVERSE : PRINT V$(I);: NORM
    AL : PRINT "(";J;")"; TAB( 9)"=";
97 1180 INPUT " ";V$
3B 1190 X(J,I) = VAL (V$)
F0 1200 NEXT J,I
09 1210 RETURN
9C 1220 REM EDIT DATA
83 1230 FOR I = 0 TO KT
7D 1240 FOR J = 1 TO NT STEP 10
7B 1250 : REM DISPLAY
5B 1260 GOSUB 1310
F6 1270 : REM EDIT
7F 1280 GOSUB 1440
15 1290 NEXT J,I
07 1300 RETURN
FD 1310 REM DISPLAY DATA
46 1320 HOME
AF 1330 PRINT L$
85 1340 A$ = CHR$ (32)
E9 1350 IF J > 10 THEN A$ = " MORE "
03 1360 PRINT "THESE ARE";A$;"VALUES OF ";V$(I);": "
AB 1370 PRINT L$: PRINT
92 1380 R = 0
8C 1390 FOR L = J TO J + 9
74 1400 IF L < = NT THEN R = R + 1: INVERSE : PRINT
    CHR$ (R + 64);: NORMAL : PRINT " #";L; TAB(
    7)"=" ";X(L,I)
7A 1410 NEXT L
A7 1420 VTAB 16: HTAB 1: PRINT L$
E5 1430 RETURN
DE 1440 REM CORRECT DATA
CB 1450 VTAB 21: HTAB 1: PRINT SPC( 9)
06 1460 VTAB 23: HTAB 1: PRINT SPC( 39)
EF 1470 VTAB 19: HTAB 1: PRINT "CORRECTIONS (Y/N) ?
    ";:CLICK = PEEK (Z)
7C 1480 GET S$
```


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```

BC 1490 IF S$ = "N" OR S$ = "n" THEN 1630
3C 1500 IF S$ < > "Y" AND S$ < > "y" THEN 1470
25 1510 VTAB 21: HTAB 1: INVERSE : PRINT "LETTER:";:
    NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
66 1520 GET S$
4F 1530 A = ASC (S$): IF A > 96 THEN A = A - 32
B1 1540 Q = A - 64
D5 1550 IF Q < 1 OR Q > R THEN 1510
79 1560 PRINT CHR$ (A)
D2 1570 VTAB (A - 60): HTAB 9: INVERSE : PRINT X(J +
    Q - 1,I)
3C 1580 VTAB 23: HTAB 1: INVERSE : PRINT "NEW VALUE:
    ";: NORMAL : PRINT CHR$ (32);
73 1590 INPUT " ";S$
B4 1600 X(J + Q - 1,I) = VAL (S$)
A2 1610 VTAB (A - 60): HTAB 9: PRINT SPC( 20);: HTAB
    9: PRINT X(J + Q - 1,I)
7A 1620 GOTO 1450
E9 1630 RETURN
44 1640 REM CHOOSE X'S
69 1650 K = 1:CV(1) = 1: IF KT = 1 THEN 1710
34 1660 : REM LABEL
8F 1670 GOSUB 1740
EE 1680 : REM CHOOSE
A3 1690 GOSUB 1850
65 1700 : REM CHECK D.F.
3A 1710 V = NT - K - 1
DB 1720 IF V < 1 THEN ETYPE = 1: GOSUB 1990: GOTO 16
    70
EB 1730 RETURN
FD 1740 REM LABEL
5A 1750 HOME
C3 1760 PRINT L$
54 1770 PRINT TAB( 10)"CHOICE OF VARIABLES"
CB 1780 PRINT L$
C2 1790 VTAB 22: HTAB 1: PRINT L$
36 1800 VTAB 5: HTAB 1: INVERSE : PRINT "X'S:";: NOR
    MAL : PRINT CHR$ (32);V$(1);
BB 1810 FOR I = 2 TO KT
B6 1820 PRINT " , ";V$(I);
BD 1830 NEXT
F1 1840 RETURN
5D 1850 REM CHOOSE
BB 1860 VTAB 8: HTAB 1: PRINT "WHICH OF THESE WOULD
    YOU LIKE TO USE IN"
D9 1870 PRINT "THIS REGRESSION RUN:"
2C 1880 K = 0
D9 1890 FOR I = 1 TO KT
91 1900 VTAB 11: HTAB 3: INVERSE : PRINT V$(I);: NOR
    MAL : HTAB 7: PRINT "(Y/N) ? ";:CLICK = PEEK
    (Z)

```

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```
6A 1910 GET S$
53 1920 A = ASC (S$): IF A > 96 THEN A = A - 32
34 1930 S$ = CHR$ (A)
5E 1940 IF S$ < > "Y" AND S$ < > "N" THEN 1900
11 1950 IF S$ = "Y" THEN K = K + 1:CV(K) = I
CB 1960 NEXT
3B 1970 IF K = 0 THEN VTAB 20: HTAB 7: PRINT "I NEED
    AT LEAST 1 VARIABLE !";BELL$; GOTO 1890
04 1980 RETURN
1C 1990 REM ERROR
39 2000 HOME
3D 2010 INVERSE : VTAB 1: HTAB 16: PRINT "WARNING:":
    NORMAL
F5 2020 VTAB 3: HTAB 1: PRINT E$(ETYPE)
DC 2030 VTAB 10: HTAB 11: PRINT "WOULD YOU LIKE TO"
4B 2040 VTAB 12: HTAB 13: INVERSE : PRINT "1";: NORM
    AL : PRINT " STOP"
BB 2050 VTAB 14: HTAB 13: INVERSE : PRINT "2";: NORM
    AL : PRINT " TRY AGAIN"
EB 2060 VTAB 16: HTAB 13: PRINT "=> ? ";BELL$;
71 2070 GET S$
15 2080 Q = VAL (S$)
4B 2090 IF Q = 1 THEN STOP
B7 2100 IF Q < > 2 THEN 2060
3C 2110 ETYPE = 0
DC 2120 RETURN
0A 2130 REM TRANSFORM DATA
93 2140 : REM INITIAL VALUES
4C 2150 GOSUB 2200
71 2160 : REM CHOOSE FROM MENU
74 2170 GOSUB 2430
B1 2180 ON PICK GOSUB 2540,2730,2920
F8 2190 RETURN
1D 2200 REM INITIAL VALUES
41 2210 HOME
7B 2220 VTAB 12: HTAB 17: PRINT "WORKING"
A4 2230 : REM Y
EA 2240 FOR I = 1 TO NT
BD 2250 XT(I,0) = X(I,0)
BE 2260 NEXT
52 2270 : REM X'S
FA 2280 FOR I = 1 TO NT
B4 2290 FOR J = 1 TO K
16 2300 XT(I,J) = X(I,CV(J))
F7 2310 NEXT J,I
3F 2320 : REM CURRENT VARIABLE NAMES
1E 2330 FOR I = 1 TO K
BD 2340 CV$(I) = V$(CV(I))
BC 2350 NEXT
11 2360 CV$(0) = "Y"
```

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```
AB 2370 : REM NUMBER OF OBSERVATIONS
45 2380 N = NT
F2 2390 : REM LAGS
31 2400 VLAG = 0:NP = 0
9A 2410 FOR PAUSE = 1 TO 2000: NEXT
E2 2420 RETURN
6B 2430 REM MENU
51 2440 HOME
5A 2450 VTAB 8: HTAB 10: PRINT "DATA TRANSFORMATIONS
"
BA 2460 FOR I = 1 TO 4
4A 2470 VTAB I * 2 + 8: HTAB 12: INVERSE : PRINT I,:
    NORMAL : PRINT CHR$ (32);DT$(I)
CA 2480 NEXT
03 2490 VTAB 18: HTAB 12: PRINT "=> ? ";BELL$;
5F 2500 GET S$
63 2510 PICK = VAL (S$)
0D 2520 IF PICK < 1 OR PICK > 4 THEN 2490
EB 2530 RETURN
E4 2540 REM LOGS
57 2550 HOME
AA 2560 VTAB 5: HTAB 15: INVERSE : PRINT "LOGARITHMS
": NORMAL
26 2570 VTAB 10: HTAB 8: PRINT "WOULD YOU LIKE TO TA
LLY"
34 2580 FOR I = 0 TO K
B0 2590 VTAB 12: HTAB 11: PRINT "LOG(";CV$(I);")"; T
    AB( 19);: INVERSE : PRINT "<Y/N>";: NORMAL ;
    PRINT SPC( 14);: HTAB 25: PRINT "? ";:CLICK
    = PEEK (Z)
61 2600 GET S$
9C 2610 IF S$ = "N" OR S$ = "n" THEN 2710
9F 2620 IF S$ < > "Y" AND S$ < > "y" THEN 2590
12 2630 VTAB 12: HTAB 25: PRINT "COMPUTING ...";
01 2640 FOR PAUSE = 1 TO 1500: NEXT PAUSE
DC 2650 FOR J = 1 TO N
EB 2660 VL = XT(J,I)
BD 2670 IF VL < = 0 THEN ETYPE = 2:J = N:I = K
CC 2680 IF VL > 0 THEN XT(J,I) = LOG (VL)
9D 2690 NEXT J
4B 2700 CV$(I) = "LOG(" + CV$(I) + ")"
7E 2710 NEXT I
EB 2720 RETURN
A1 2730 REM RECIPROCAL
57 2740 HOME
0E 2750 VTAB 5: HTAB 15: INVERSE : PRINT "RECIPROCAL
S": NORMAL
26 2760 VTAB 10: HTAB 8: PRINT "WOULD YOU LIKE TO TA
LLY"
34 2770 FOR I = 0 TO K
```

```

9C 2780 VTAB 12: HTAB 12: PRINT "1/";CV$(I); TAB( 18
) ; INVERSE : PRINT "<Y/N>"; NORMAL : PRINT
SPC( 14); HTAB 24: PRINT "? ";CLICK = PEE
K (Z)
87 2790 GET S$
9C 2800 IF S$ = "N" OR S$ = "n" THEN 2900
9F 2810 IF S$ < > "Y" AND S$ < > "y" THEN 2780
11 2820 VTAB 12: HTAB 24: PRINT "COMPUTING ...";
01 2830 FOR PAUSE = 1 TO 1500: NEXT PAUSE
DC 2840 FOR J = 1 TO N
EB 2850 VL = XT(J,I)
9B 2860 IF VL = 0 THEN ETYPE = 3:J = N:I = K
84 2870 IF VL < > 0 THEN XT(J,I) = 1 / VL
9D 2880 NEXT J
FB 2890 CV$(I) = "1/" + CV$(I)
7E 2900 NEXT I
EB 2910 RETURN
87 2920 REM LAG
57 2930 HOME
DE 2940 HTAB 18: INVERSE : PRINT "LAGS"
15 2950 VTAB 3: HTAB 1: PRINT "CURRENT X'S:"; NORMA
L : PRINT " ";CV$(1);
BC 2960 IF K > 1 THEN FOR I = 2 TO K: PRINT ", ";CV$
(I);: NEXT
2B 2970 : REM CHOOSE X
F6 2980 VTAB 6: HTAB 19: PRINT SPC( 10);BELL$
AC 2990 VTAB 6: HTAB 1: INPUT "VARIABLE TO LAG ? ";K
$
D7 3000 VLAG = 0
11 3010 FOR I = 1 TO K
64 3020 IF K$ = CV$(I) THEN VLAG = I
AF 3030 NEXT
9A 3040 IF VLAG = 0 THEN 2980
15 3050 : REM ENTER PERIODS TO LAG
16 3060 VTAB 8: HTAB 1: PRINT "PLEASE ENTER THE NUMB
ER OF PERIODS TO"
1B 3070 PRINT "LAG IT. UP TO ";V - 1;" ARE AVAILABL
E."
15 3080 VTAB 11: HTAB 12: PRINT SPC( 10);BELL$
85 3090 VTAB 11: HTAB 1: INPUT "NUMBER = ? ";N$
72 3100 NP = INT ( VAL (N$))
4B 3110 IF NP < 0 OR NP > V - 1 THEN 3080
D0 3120 : REM LAG IT
7B 3130 FOR I = NP + 1 TO N
9D 3140 FOR J = 0 TO K
EA 3150 IF J = VLAG THEN 3170
F4 3160 XT(I - NP,J) = XT(I,J)
0D 3170 NEXT J,I
1F 3180 N = N - NP
A5 3190 V = V - NP

```

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```
D7 3200 RETURN
04 3210 REM COMPUTE
46 3220 HOME
A0 3230 VTAB 12: HTAB 15: PRINT "COMPUTING"
B4 3240 : REM INSERT CONSTANT
71 3250 GOSUB 3430
63 3260 : REM X'X
A5 3270 GOSUB 3580
98 3280 : REM INVERT
A1 3290 GOSUB 3660
5 3300 : REM X'Y
83 3310 GOSUB 3850
8C 3320 : REM B
77 3330 GOSUB 3920
7F 3340 : REM RESIDUALS
B7 3350 GOSUB 3990
F2 3360 : REM SUMS OF SQUARES
8D 3370 GOSUB 4070
C7 3380 : REM GOODNESS-OF-FIT STATISTICS
7D 3390 GOSUB 4230
38 3400 : REM DW
8F 3410 GOSUB 4290
E3 3420 RETURN
3D 3430 REM INSERT CONSTANT
3D 3440 FOR I = K TO 1 STEP - 1
D9 3450 FOR J = 1 TO N
7E 3460 XT(J,I + 1) = XT(J,I)
13 3470 NEXT J,I
65 3480 FOR I = 1 TO N
80 3490 XT(I,1) = 1
AD 3500 NEXT
D9 3510 : REM RELOCATE VARIABLE NAMES
37 3520 FOR I = K TO 1 STEP - 1
7C 3530 CV$(I + 1) = CV$(I)
BD 3540 NEXT
59 3550 CV$(1) = "CONSTANT"
6E 3560 K = K + 1
F9 3570 RETURN
A6 3580 REM X'X
3B 3590 FOR I = 1 TO K
99 3600 FOR J = 1 TO K
B4 3610 CP(I,J) = 0
D2 3620 FOR L = 1 TO N
F3 3630 CP(I,J) = CP(I,J) + XT(L,I) * XT(L,J)
13 3640 NEXT L,J,I
F3 3650 RETURN
37 3660 REM INVERT
E2 3670 : REM TACK ON IDENTITY
39 3680 FOR I = 1 TO K
BD 3690 FOR J = 1 TO K
```

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```
98 3700 CP(I,K + J) = 0
C3 3710 IF I = J THEN CP(I,K + J) = 1
05 3720 NEXT J,I
0E 3730 : REM INVERT
2B 3740 FOR I = 1 TO K
A4 3750 C = CP(I,I)
9A 3760 FOR J = 1 TO 2 * K
CB 3770 CP(I,J) = CP(I,J) / C
9C 3780 NEXT J
BF 3790 FOR J = 1 TO K
E5 3800 X = CP(J,I)
89 3810 FOR L = 1 TO 2 * K
D2 3820 IF J < > I THEN CP(J,L) = CP(J,L) - X * CP(I
,L)
13 3830 NEXT L,J,I
F3 3840 RETURN
A2 3850 REM X'Y
35 3860 FOR I = 1 TO K
49 3870 XY(I) = 0
ED 3880 FOR J = 1 TO N
CA 3890 XY(I) = XY(I) + XT(J,I) * XT(J,0)
01 3900 NEXT J,I
E9 3910 RETURN
C4 3920 REM TALLY B
2B 3930 FOR I = 1 TO K
27 3940 B(I) = 0
B3 3950 FOR J = 1 TO K
07 3960 B(I) = B(I) + CP(I,J + K) * XY(J)
1D 3970 NEXT J,I
06 3980 RETURN
C3 3990 REM RESIDUALS
3E 4000 FOR I = 1 TO N
E0 4010 YH = 0
96 4020 FOR J = 1 TO K
2D 4030 YH = YH + XT(I,J) * B(J)
E6 4040 E(I) = XT(I,0) - YH
04 4050 NEXT J,I
EC 4060 RETURN
60 4070 REM SUMS OF SQUARES
7F 4080 : REM TOTAL
F8 4090 S = 0:SS = 0
40 4100 FOR I = 1 TO N
E2 4110 S = S + XT(I,0)
28 4120 SS = SS + XT(I,0) ^ 2
B2 4130 NEXT
55 4140 TSS = SS - S * S / N
35 4150 : REM ERROR
D3 4160 ESS = 0
5C 4170 FOR I = 1 TO N
BF 4180 ESS = ESS + E(I) * E(I)
```


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```
CA 4190 NEXT
F2 4200 : REM REGRESSION
E6 4210 RSS = TSS - ESS
E0 4220 RETURN
BA 4230 REM GOODNESS-OF-FIT STATISTICS
EC 4240 EV = ESS / V
4F 4250 RQ = RSS / TSS
E8 4260 RBSQ = 1 - EV / (TSS / (N - 1))
3C 4270 F = RSS / (K - 1) / EV
F8 4280 RETURN
5A 4290 REM DW STATISTIC
85 4300 S = 0
4A 4310 FOR I = 2 TO N
C3 4320 S = S + (E(I) - E(I - 1)) ^ 2
B6 4330 NEXT
3E 4340 DW = S / ESS
EE 4350 RETURN
D8 4360 REM DISPLAY RESULTS
8F 4370 : REM EQUATION
8A 4380 GOSUB 4440
FF 4390 : REM SUMS OF SQUARES
74 4400 GOSUB 4640
42 4410 : REM KEY TERMS
A8 4420 GOSUB 4790
E8 4430 RETURN
28 4440 REM EQUATION
57 4450 HOME
C8 4460 PRINT L$
ED 4470 PRINT TAB( 11)"REGRESSION EQUATION
C8 4480 PRINT L$
64 4490 PRINT "N = ";N
54 4500 IF N < NT THEN VTAB 4: HTAB 9: PRINT "(";CV$
(VLAG + 1);" LAGGED ";NP;" PERIODS)"
49 4510 VTAB 5: HTAB 1: PRINT "DEPENDENT VARIABLE: "
;CV$(0)
46 4520 VTAB 7: HTAB 15: PRINT "ESTIMATED"
A9 4530 VTAB 8: HTAB 1: PRINT "TERM"; TAB( 17)"VALUE
"; TAB( 33)"T-RATIO"
28 4540 FOR I = 1 TO K
52 4550 T = B(I) / SQR (EV * CP(I,I + K))
68 4560 VTAB I + 9: HTAB 1: PRINT CV$(I)
81 4570 VTAB I + 9:HT = 23:NR = B(I): GOSUB 9000
D5 4580 VTAB I + 9:HT = 39:NR = T: GOSUB 9000
D2 4590 NEXT
A1 4600 VTAB 23: HTAB 1: PRINT L$
77 4610 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
68 4620 GET S$
EC 4630 RETURN
68 4640 REM SUMS OF SQUARES
58 4650 HOME
```

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```

C4 4660 PRINT L$
BF 4670 PRINT TAB( 13)"SUMMARY VALUES
CC 4680 PRINT L$
93 4690 PRINT TAB( 33)"DEGREES"
9A 4700 PRINT "VARIATION"; TAB( 20)"SUMS OF"; TAB( 3
    5)"OF"
AB 4710 PRINT TAB( 3)"IN Y"; TAB( 20)"SQUARES"; TAB(
    33)"FREEDOM"
F2 4720 VTAB 8: HTAB 1: PRINT "TOTAL";:HT = 26:NR =
    TSS: GOSUB 9000
FA 4730 VTAB 8:HT = 37:DA = 0:NR = N - 1: GOSUB 9000
    :DA = 3
B1 4740 VTAB 9: HTAB 1: PRINT "REGRESSION";:HT = 26:
    NR = RSS: GOSUB 9000
01 4750 VTAB 9:HT = 37:DA = 0:NR = K - 1: GOSUB 9000
    :DA = 3
4D 4760 VTAB 10: HTAB 1: PRINT "RESIDUAL";:HT = 26:N
    R = ESS: GOSUB 9000
BA 4770 VTAB 10:HT = 37:DA = 0:NR = V: GOSUB 9000:DA
    = 3
03 4780 RETURN
A6 4790 REM KEY TERMS
9B 4800 VTAB 13: HTAB 1: PRINT "R-SQUARED"; TAB( 17)
    "=";:HT = 32:NR = RQ: GOSUB 9000
D0 4810 VTAB 14: HTAB 1: PRINT "R-BAR SQUARED"; TAB(
    17)"=";:NR = RBSQ: GOSUB 9000
00 4820 VTAB 16: HTAB 1: PRINT "F-STATISTIC"; TAB( 1
    7)"=";:NR = F: GOSUB 9000
04 4830 VTAB 18: HTAB 1: PRINT "STANDARD ERROR"
D0 4840 VTAB 19: HTAB 1: PRINT "OF THE ESTIMATE"; TA
    B( 17)"=";:NR = SQR (EV): GOSUB 9000
04 4850 VTAB 21: HTAB 1: PRINT "DURBIN-WATSON"; TAB(
    17)"=";:NR = DW: GOSUB 9000
0B 4860 VTAB 22: HTAB 1: PRINT L$
01 4870 RETURN
57 9000 REM "PRINT USING" SUBROUTINE
00 9010 ZR$ = "":ZS$ = "":ZD$ = "":ZZ$ = "0000000000"
4A 9020 N$ = STR$ (NR)
B9 9030 IF DOLL$ = "YES" THEN ZD$ = "$"
D6 9040 IF NR < 0 THEN ZS$ = "-"
4A 9050 LET ZN = ABS (NR) + 5 * 10 ^ - (DA + 1)
2F 9060 LET ZL = INT (ZN):ZR = INT ((ZN - ZL) * 10 ^
    DA)
AC 9070 IF DA > 0 THEN ZR$ = "." + RIGHT$ (ZZ$ + STR
    $ (ZR),DA)
49 9080 ZF$ = " " + STR$ (ZL)
72 9090 IF MID$ (ZT$, LEN (ZT$) - 3,1) < > "E" THEN
    N$ = ZS$ + ZD$ + STR$ (ZL) + ZR$
61 9100 HTAB (HT + 1 - LEN (N$)): PRINT N$
DF 9110 RETURN

```

T-TEST

When using regression analysis, you seldom know for sure if a particular explanatory variable actually influences Y . You tentatively choose variables on the basis of accepted theory, common sense, or intuition. Then, using an operation called the *t*-test, you decide which explanatory variables are important and which are superfluous.

To attempt to determine whether U.S. income influences the volume of immigration, perform a *t*-test on the income variable.

To conduct the test, you must create a null hypothesis, establish a test criterion, compute a *t*-curve critical value, and compare the critical value to the observed *t*-value. If the observed *t*-ratio is greater than the critical value, you can reject the null hypothesis and conclude that the explanatory variable does influence Y .

If the above paragraph leaves you cold, try carrying out these steps:

Null hypothesis. Yearly immigration is not related to yearly income.

Test criterion. Reject the null hypothesis if the observed *t*-ratio is greater than the *t*-critical value at the 5 percent level of significance.

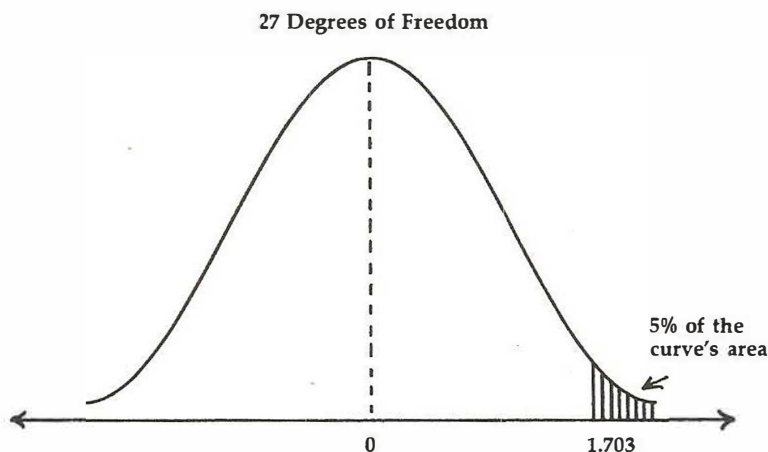
Critical value. The *t*-critical value depends on the number of degrees of freedom. To find out how many there are in the example, simply subtract the number of parameters in the regression equation (3) from the number of observations (30). Entering 27 degrees of freedom into the Apple program gives a *t*-critical value of 1.703.

Comparison. As Figure 7-3 shows, 5 percent of all *t*-values are to the right of 1.703. Since the actual, or observed, *t*-ratio is 6.951 (from "Super Curve-Fitter"), reject the null hypothesis and conclude that income does influence immigration.

Although the *t*-test is not foolproof, it is useful for sorting out what's important when doing regression analysis. To save you the trouble of looking up *t*-critical values in the back of a statistics book, the Apple generates these numbers in a jiffy. It does this for *one-tail* tests, in which the explanatory variable

can influence Y in only one way, as well as for *two-tail* tests, where that influence can be either positive or negative.

Figure 7-3. T-Curve



Program 7-3. T-Test

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```

23 100 REM T-CURVE CRITICAL VALUES
A6 110 REM INITIALIZE
47 120 GOSUB 250
B9 130 REM ENTER DEGREES OF FREEDOM
54 140 GOSUB 770
91 150 REM COMPUTE VALUES
55 160 GOSUB 850
5D 170 REM DISPLAY VALUES
ED 180 GOSUB 1080
9C 190 VTAB 23: HTAB 7: PRINT "ANOTHER CALCULATION (
      Y/N) ? ";BELL$;
53 200 GET S$
D4 210 IF S$ = "Y" OR S$ = "y" THEN 140
0B 220 IF S$ < > "N" AND S$ < > "n" THEN 190
A7 230 HOME : PRINT "BYE-BYE"
92 240 END
AF 250 REM INITIALIZE
51 260 : REM TITLE
4F 270 GOSUB 330
0B 280 : REM INSTRUCTIONS
5F 290 GOSUB 390
    
```

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```
02 300 : REM KEY VALUES
46 310 GOSUB 530
17 320 RETURN
2A 330 REM TITLE
20 340 PRINT CHR$ (21): TEXT : HOME
95 350 VTAB 12: HTAB 8: PRINT "T-CURVE CRITICAL VALU
ES"
02 360 FOR PAUSE = 1 TO 2500: NEXT
98 370 BELL$ = CHR$ (7)
23 380 RETURN
8F 390 REM INSTRUCTIONS
47 400 HOME
66 410 PRINT "THIS PROGRAM COMPUTES T-CURVE CRITICAL
"
E8 420 PRINT "VALUES FOR USE IN HYPOTHESIS TESTING."
: PRINT
CA 430 PRINT "ENTER THE NUMBER OF DEGREES OF FREEDOM
,"
F1 440 PRINT "AND CRITICAL VALUES WILL BE TALLIED AT
"
E1 450 PRINT "THE 10%, 5%, AND 1% LEVELS OF SIGNIFI-
"
8E 460 PRINT "CANCE FOR A TWO-TAIL TEST.": PRINT
FA 470 PRINT "AND THEY WILL BE TALLIED AT THE 5.0%,"
B1 480 PRINT "2.5%, AND 0.5% LEVELS FOR A ONE-TAIL"
C3 490 PRINT "TEST."
5D 500 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
58 510 GET S$
19 520 RETURN
62 530 REM KEY VALUES
86 540 : REM FOR APPROXIMATIONS
B0 550 DATA 1.6449, 1.9600, 2.5758
0C 560 DATA 3.5283, 0.60033, -0.82847
1B 570 DATA 0.85602, 0.95910, 1.8745
7D 580 DATA 1.2209, -0.90259, -2.2311
A3 590 DATA -1.5162, 0.11588, 1.5631
ED 600 READ A(1), A(2), A(3)
82 610 READ B(1), B(2), B(3)
17 620 READ C(1), C(2), C(3)
AB 630 READ D(1), D(2), D(3)
46 640 READ E(1), E(2), E(3)
6F 650 : REM ACTUALS (V=1, 2, & 3)
7E 660 DATA 6.314, 12.706, 63.657
2B 670 DATA 2.920, 4.303, 9.925
68 680 DATA 2.353, 3.182, 5.841
04 690 FOR I = 1 TO 3
33 700 FOR J = 1 TO 3
26 710 READ TA(I, J)
AB 720 NEXT J, I
64 730 L$ = "": FOR I = 1 TO 39: L$ = L$ + CHR$ (61):
NEXT
```

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```
A7 740 : REM DECIMAL PLACES
CC 750 DA = 3
23 760 RETURN
FB 770 REM DEGREES OF FREEDOM
5A 780 HOME
21 790 VTAB 1: HTAB 1: PRINT "HOW MANY DEGREES OF FR
    EEDOM DO YOU HAVE:"
2B 800 VTAB 3: HTAB 7: PRINT SPC( 10);BELL$
5D 810 VTAB 3: HTAB 1: INPUT "=> ? ";V$
9B 820 V = INT ( VAL (V$))
BA 830 IF V < = 0 THEN 800
20 840 RETURN
36 850 REM COMPUTE
57 860 HOME
DA 870 : REM USE APPROXIMATION FORMULA FOR FOUR OR M
    ORE D.O.F.
DC 880 IF V > 3 THEN GOSUB 920
C4 890 : REM USE ACTUAL VALUES OTHERWISE
EC 900 IF V < = 3 THEN GOSUB 1030
1B 910 RETURN
B9 920 REM APPROXIMATION
BA 930 : REM T(1)=10% LEVEL, T(2)=5% LEVEL, T(3)=1%
    LEVEL
FC 940 FOR I = 1 TO 3
B1 950 : REM NUMERATOR
59 960 NU = A(I) * V + B(I) + C(I) / V
55 970 : REM DENOMINATOR
25 980 DE = V + D(I) + E(I) / V
BA 990 : REM QUOTIENT
3A 1000 T(I) = NU / DE
A5 1010 NEXT
D9 1020 RETURN
41 1030 REM ACTUAL
99 1040 FOR I = 1 TO 3
17 1050 T(I) = TA(V,I)
B9 1060 NEXT
ED 1070 RETURN
6E 1080 REM DISPLAY VALUES
6D 1090 : REM TWO-TAIL
51 1100 GOSUB 1140
10 1110 : REM ONE-TAIL
49 1120 GOSUB 1310
DF 1130 RETURN
8E 1140 REM TWO-TAIL
B3 1150 PRINT L$
4B 1160 HTAB 9: PRINT "T-CURVE CRITICAL VALUES"
A1 1170 HTAB 11: PRINT "FOR A TWO-TAIL TEST"
BF 1180 PRINT L$
E0 1190 VTAB 6: HTAB 1: PRINT "DEGREES OF FREEDOM: "
    ;: INVERSE : PRINT V: NORMAL
```


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```

8D 1200 VTAB 10: HTAB 6: PRINT "LEVEL OF"; TAB( 21)"
    CRITICAL VALUES"
D2 1210 PRINT TAB( 4)"SIGNIFICANCE"; TAB( 22)"LOWER"
    ; SPC( 3); "UPPER"
22 1220 LS$(1) = "10%":LS$(2) = " 5%":LS$(3) = " 1%"
99 1230 FOR I = 1 TO 3
DF 1240 VTAB I * 2 + 11: HTAB 8: PRINT LS$(I);:HT =
    26:NR = - T(I): GOSUB 9000
DC 1250 VTAB I * 2 + 11:HT = 34:NR = T(I): GOSUB 900
    0
BD 1260 NEXT
AE 1270 VTAB 21: HTAB 1: PRINT L$
86 1280 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
7C 1290 GET S$
D7 1300 RETURN
E6 1310 REM ONE-TAIL
46 1320 HOME
AF 1330 PRINT L$
47 1340 HTAB 9: PRINT "T-CURVE CRITICAL VALUES"
B5 1350 HTAB 11: PRINT "FOR A ONE-TAIL TEST"
BB 1360 PRINT L$
DC 1370 VTAB 6: HTAB 1: PRINT "DEGREES OF FREEDOM: "
    ;: INVERSE : PRINT V: NORMAL
E0 1380 VTAB 10: HTAB 6: PRINT "LEVEL OF"; TAB( 21)"
    CRITICAL VALUE"
61 1390 PRINT TAB( 4)"SIGNIFICANCE"; TAB( 25)" + OR -
    "
47 1400 LS$(1) = "5.0%":LS$(2) = "2.5%":LS$(3) = "0.
    5%"
95 1410 FOR I = 1 TO 3
DC 1420 VTAB I * 2 + 11: HTAB 8: PRINT LS$(I);:HT =
    30:NR = T(I): GOSUB 9000
B5 1430 NEXT
A6 1440 VTAB 21: HTAB 1: PRINT L$
ED 1450 RETURN
57 9000 REM "PRINT USING" SUBROUTINE
08 9010 ZR$ = "":ZS$ = "":ZD$ = "":ZZ$ = "0000000000"
4A 9020 N$ = STR$(NR)
B9 9030 IF DOLL$ = "YES" THEN ZD$ = "$"
D6 9040 IF NR < 0 THEN ZS$ = "-"
4A 9050 LET ZN = ABS (NR) + 5 * 10 ^ - (DA + 1)
2F 9060 LET ZL = INT (ZN):ZR = INT ((ZN - ZL) * 10 ^
    DA)
AC 9070 IF DA > 0 THEN ZR$ = "." + RIGHT$( ZZ$ + STR
    $(ZR),DA)
49 9080 ZT$ = " " + STR$( ZL)
72 9090 IF MID$( ZT$, LEN (ZT$) - 3,1) < > "E" THEN
    N$ = ZS$ + ZD$ + STR$( ZL) + ZR$
61 9100 HTAB (HT + 1 - LEN (N$)): PRINT N$
DF 9110 RETURN

```

SIMULTANEOUS EQUATION SOLVER

Remember those math problems where you have to solve N equations for N unknowns? Well, worry no more, this Apple program does the solving for you.

While it's important to be able to solve simultaneous equations manually, it's much easier to use this program once you understand the principles involved. Here are two simultaneous equations:

$$5 * (X1) + 2 * (X2) = 16$$

$$3 * (X1) + 4 * (X2) = 18$$

After telling the Apple you have two equations, enter the column of constants (16 and 18), and then type in the coefficients of the variable $X1$ (5 and 3) followed by those of $X2$ (2 and 4).

The Apple computes the solution: $X1 = 2$ and $X2 = 3$. It's quick and easy with your Apple, and you're free to interpret the meaning of the numbers and go on to the next problem.

Program 7-4. Simultaneous Equation Solver

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
8F 100 REM SIMULTANEOUS EQUATION SOLVER
4B 110 : REM INITIALIZE
43 120 GOSUB 230
B9 130 : REM ENTER NUMBER OF EQUATIONS
56 140 GOSUB 590
B2 150 : REM ENTER DATA
57 160 GOSUB 670
58 170 : REM COMPUTE
E5 180 GOSUB 1440
DC 190 : REM DISPLAY RESULT
D5 200 GOSUB 2150
A3 210 HOME : PRINT "BYE-BYE"
8E 220 END
AB 230 REM INITIALIZE
4D 240 : REM TITLE
47 250 GOSUB 310
BD 260 : REM KEY VALUES
```

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```
57 270 GOSUB 370
08 280 : REM INSTRUCTIONS
51 290 GOSUB 510
13 300 RETURN
26 310 REM TITLE
29 320 PRINT CHR$ (21): TEXT : HOME
7A 330 VTAB 12: HTAB 6: PRINT "SIMULTANEOUS EQUATION
    SOLVER"
7D 340 FOR PAUSE = 1 TO 1500: NEXT
8A 350 BELL$ = CHR$ (7):W = - 16336: REM CLICK
1F 360 RETURN
68 370 REM KEY VALUES
DA 380 : REM MAX NUMBER OF EQUATIONS
46 390 DATA 25
75 400 READ NX
76 410 DIM X(NX,NX),Q(NX,NX),R(NX,NX),C(NX),S(NX),V$
    (NX)
3C 420 : REM SYMBOLS
75 430 V$(0) = "Y"
5E 440 FOR I = 1 TO NX
F9 450 V$(I) = "X" + STR$ (I)
08 460 NEXT
69 470 L$ = "": FOR I = 1 TO 39:L$ = L$ + CHR$ (61):
    NEXT
76 480 : REM DIGITS AFTER DECIMAL
D1 490 DA = 3
15 500 RETURN
81 510 REM INSTRUCTIONS
4C 520 HOME
8E 530 PRINT "THIS PROGRAM SOLVES UP TO ";: INVERSE
    : PRINT NX;: NORMAL : PRINT " EQUATIONS"
76 540 PRINT "FOR ";: INVERSE : PRINT NX;: NORMAL :
    PRINT " UNKNOWN."; PRINT
21 550 PRINT "CHANGE LINE 390 FOR A BIGGER LIMIT."
69 560 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
64 570 GET S$
25 580 RETURN
39 590 REM # OF EQUATIONS
49 600 HOME
8D 610 VTAB 1: HTAB 34: PRINT SPC( 10);BELL$
01 620 VTAB 1: HTAB 1: INPUT "HOW MANY EQUATIONS DO
    YOU HAVE ? ";S$
FA 630 N = INT ( VAL (S$))
41 640 IF N < 1 THEN 610
6A 650 IF N > NX THEN VTAB 23: HTAB 10: PRINT "ONLY
    ";NX;" ARE ALLOWED !": GOTO 610
22 660 RETURN
67 670 REM ENTER DATA
84 680 : REM ON Y
5F 690 GOSUB 750
```

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```
C4 700 : REM ON COEFFICIENTS
59 710 GOSUB 890
9D 720 : REM EDIT
D1 730 GOSUB 1020
1F 740 RETURN
09 750 REM Y
56 760 HOME
80 770 PRINT "PLEASE ENTER OBSERVATIONS ON THE 'Y'"
A7 780 PRINT "VARIABLE IN EACH EQUATION.": PRINT
F7 790 PRINT "IF 3*(X1) + 5*(X2) = 7, FOR EXAMPLE,"
6D 800 PRINT "THEN ENTER ";: INVERSE : PRINT "7";: N
    ORMAL : PRINT "."
0F 810 FOR J = 1 TO N
D3 820 VTAB 8: HTAB 1: INVERSE : PRINT "EQUATION:":;
    NORMAL : PRINT CHR$ (32);J
1F 830 CLICK = PEEK (W)
EA 840 VTAB 10: HTAB 9: PRINT SPC( 20)
A0 850 VTAB 10: HTAB 3: INPUT "Y = ? ";V$
39 860 X(J,0) = VAL (V$)
73 870 NEXT J
28 880 RETURN
FB 890 REM COEFFICIENTS
CD 900 FOR I = 1 TO N
4E 910 HOME
1D 920 PRINT "PLEASE ENTER THE COEFFICIENT OF THE ";
    : INVERSE : PRINT V$(I): NORMAL
28 930 PRINT "TERM IN EACH EQUATION.":BELL$
16 940 FOR J = 1 TO N
D8 950 VTAB 4: HTAB 1: INVERSE : PRINT "EQUATION:":;
    NORMAL : PRINT CHR$ (32);J
26 960 CLICK = PEEK (W)
9E 970 VTAB 7: HTAB 19: PRINT SPC( 10)
37 980 VTAB 7: HTAB 3: INPUT "COEFFICIENT = ? ";V$
CC 990 X(J,I) = VAL (V$)
EC 1000 NEXT J,I
D5 1010 RETURN
98 1020 REM EDIT DATA
45 1030 FOR I = 0 TO N
55 1040 FOR J = 1 TO N STEP 10
77 1050 : REM DISPLAY
4F 1060 GOSUB 1110
F2 1070 : REM EDIT
73 1080 GOSUB 1240
11 1090 NEXT J,I
D3 1100 RETURN
F9 1110 REM DISPLAY DATA
42 1120 HOME
AB 1130 PRINT L$
9A 1140 A$ = "VALUES"
8B 1150 IF I > 0 THEN A$ = "COEFFICIENTS"
```

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```
CD 1160 PRINT "THESE ARE ";A$;" OF ";V$(I);":"
A7 1170 PRINT L$: PRINT
8E 1180 R = 0
8B 1190 FOR L = J TO J + 9
6F 1200 IF L <= N THEN R = R + 1: INVERSE : PRINT C
      HR$ (R + 64);: NORMAL : PRINT " #";L; TAB( 7
      )"= ";X(L,I)
76 1210 NEXT L
A3 1220 VTAB 16: HTAB 1: PRINT L$
E1 1230 RETURN
DA 1240 REM CORRECT DATA
C7 1250 VTAB 21: HTAB 1: PRINT SPC( 9)
D2 1260 VTAB 23: HTAB 1: PRINT SPC( 39)
2B 1270 VTAB 19: HTAB 1: PRINT "CORRECTIONS (Y/N) ?
      " ;:CLICK = PEEK (W)
78 1280 GET S$
84 1290 IF S$ = "N" OR S$ = "n" THEN 1430
18 1300 IF S$ < > "Y" AND S$ < > "y" THEN 1270
15 1310 VTAB 21: HTAB 1: INVERSE : PRINT "LETTER:";:
      NORMAL : PRINT CHR$ (32);:CLICK = PEEK (W)
62 1320 GET S$
4B 1330 A = ASC (S$): IF A > 96 THEN A = A - 32
AD 1340 Q = A - 64
C1 1350 IF Q < 1 OR Q > R THEN 1310
75 1360 PRINT CHR$ (A)
CE 1370 VTAB (A - 60): HTAB 9: INVERSE : PRINT X(J +
      Q - 1,I)
38 1380 VTAB 23: HTAB 1: INVERSE : PRINT "NEW VALUE:
      " ;: NORMAL : PRINT CHR$ (32);
6F 1390 INPUT " ";S$
8B 1400 X(J + Q - 1,I) = VAL (S$)
9E 1410 VTAB (A - 60): HTAB 9: PRINT SPC( 20);: HTAB
      9: PRINT X(J + Q - 1,I)
72 1420 GOTO 1250
E5 1430 RETURN
12 1440 REM COMPUTE
54 1450 HOME
AF 1460 VTAB 12: HTAB 16: PRINT "COMPUTING"
E7 1470 FOR Z = 1 TO N
C5 1480 : REM KEY ELEMENT OF R
7F 1490 GOSUB 1620
E8 1500 : REM COLUMN OF Q
99 1510 GOSUB 1690
F1 1520 : REM COLUMN OF R
69 1530 GOSUB 1810
5A 1540 : REM ELEMENT OF C
B1 1550 GOSUB 1890
18 1560 : REM REVISE X
9D 1570 GOSUB 1950
A6 1580 NEXT Z
```

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```
37 1590 : REM BACKSOLVE
49 1600 GOSUB 2020
E1 1610 RETURN
BA 1620 REM KEY ELEMENT OF R
84 1630 R = 0
57 1640 FOR I = 1 TO N
FB 1650 R = R + X(I,Z) * X(I,Z)
8F 1660 NEXT I
4B 1670 R(Z,Z) = SQR (R)
FD 1680 RETURN
77 1690 REM COLUMN OF Q
49 1700 FOR I = 1 TO N
D6 1710 IF R(Z,Z) = 0 THEN GOSUB 1750: STOP
1D 1720 Q(I,Z) = X(I,Z) / R(Z,Z)
85 1730 NEXT I
EF 1740 RETURN
08 1750 REM ERROR
5E 1760 HOME
1D 1770 VTAB 5: HTAB 17: INVERSE : PRINT "SORRY:": N
    ORMAL
EA 1780 VTAB 7: HTAB 1: PRINT "YOUR EQUATIONS ARE EI
    THER INCONSISTENT"
E1 1790 PRINT "OR REDUNDANT, AND I CAN'T CONTINUE."
E1 1800 RETURN
DB 1810 REM COLUMN OF R
A6 1820 IF Z = N THEN 1880
A3 1830 FOR L = Z + 1 TO N
67 1840 R(Z,L) = 0
5F 1850 FOR I = 1 TO N
AB 1860 R(Z,L) = R(Z,L) + X(I,L) * Q(I,Z)
24 1870 NEXT I,L
02 1880 RETURN
2C 1890 REM ELEMENT OF C
69 1900 C(Z) = 0
51 1910 FOR I = 1 TO N
DB 1920 C(Z) = C(Z) + X(I,0) * Q(I,Z)
89 1930 NEXT I
F3 1940 RETURN
F4 1950 REM REVISE X
53 1960 IF Z = N THEN 2010
69 1970 FOR I = 1 TO N
B9 1980 FOR L = Z + 1 TO N
18 1990 X(I,L) = X(I,L) - Q(I,Z) * R(Z,L)
EF 2000 NEXT L,I
D6 2010 RETURN
65 2020 REM BACKSOLVE
EB 2030 S(N) = C(N) / R(N,N)
DB 2040 IF N = 1 THEN 2140
D9 2050 FOR I = N - 1 TO 1 STEP - 1
4A 2060 : REM LEFT-SIDE SUM
```


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```

99 2070 S = 0
85 2080 FOR J = I + 1 TO N
4C 2090 S = S + R(I,J) * S(J)
6F 2100 NEXT J
F7 2110 : REM SOLUTION
9D 2120 S(I) = (C(I) - S) / R(I,I)
7A 2130 NEXT I
E4 2140 RETURN
91 2150 REM DISPLAY RESULT
DF 2160 FOR I = 1 TO N STEP 10
57 2170 HOME
C0 2180 PRINT L$
F8 2190 PRINT TAB( 16)"SOLUTION"
8E 2200 PRINT L$: PRINT
88 2210 FOR J = I TO I + 9
8D 2220 IF J <= N THEN PRINT TAB( 15);V$(J); TAB( 2
    0)"=";:HT = 33:NR = S(J): GOSUB 9000
7D 2230 NEXT J
A3 2240 VTAB 21: HTAB 1: PRINT L$
7B 2250 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
71 2260 GET S$
8C 2270 NEXT I
F6 2280 RETURN
37 9000 REM "PRINT USING" SUBROUTINE
08 9010 ZR$ = "":ZS$ = "":ZD$ = "":ZZ$ = "0000000000"
4A 9020 N$ = STR$(NR)
B9 9030 IF DOLL$ = "YES" THEN ZD$ = "$"
D6 9040 IF NR < 0 THEN ZS$ = "-"
4A 9050 LET ZN = ABS (NR) + 5 * 10 ^ - (DA + 1)
2F 9060 LET ZL = INT (ZN):ZR = INT ((ZN - ZL) * 10 ^
    DA)
AC 9070 IF DA > 0 THEN ZR$ = "." + RIGHT$ (ZZ$ + STR
    $(ZR),DA)
49 9080 ZT$ = " " + STR$ (ZL)
72 9090 IF MID$ (ZT$, LEN (ZT$) - 3,1) < > "E" THEN
    N$ = ZS$ + ZD$ + STR$ (ZL) + ZR$
61 9100 HTAB (HT + 1 - LEN (N$)): PRINT N$
DF 9110 RETURN

```

CURVE PLOTTER

If $X = 2$, then $Y = 8$, and if $X = 3$, then $Y = 27$. If you have ever tried to understand a function, you know the value of plotting. It helps to have a mental image. Now there's an easier way to picture the function. Let the Apple plot it on the screen.

Enter the equation of your curve into line 240 of Program 7-5 using correct syntax. Here are a few examples, written in standard form:

$Y = 50$	Constant
$Y = 5 + 2 * X$	Linear
$Y = 0.01 * X^2$	Parabolic
$Y = 10 + 75 * \text{COS}(X)$	Trigonometric

Next, run the program. The Apple will draw your function in high-resolution graphics using default scaling values for the X- and Y-axes. You can easily change these parameters to either expand or scale down the graph—just follow the Apple's prompts.

If your curve closely hugs the X-axis, for example, chances are good that you need to make the Y-axis intervals smaller. In any event, it's probably a good idea to experiment with several different scales for every function you plot. This can yield surprising results. Another nice feature of this program is that the Apple will compute the value of Y that corresponds to any value of X *while you view the curve*.

The function you see when you run the program with line 240 as it is in the program listing is a rectangular hyperbola. One more interesting function is $Y = \sin(X)$, with the X-axis interval at $6.28 (2 * \pi)$ and the Y-axis interval at 0.3.

Program 7-5. Curve Plotter

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
EE 100 LOMEM: 17000
50 110 REM CURVE PLOTTER
40 120 : REM INITIALIZE
40 130 GOSUB 300
A3 140 : REM PLOT CURVE
54 150 GOSUB 950
5F 160 : REM CHOOSE FROM MENU
E3 170 GOSUB 1820
```

SCIENCE AND STATISTICS

```
93 180 ON PICK GOSUB 2070,2190
12 190 IF PICK < > 3 THEN 170
E0 200 TEXT : HOME : PRINT "BYE-BYE"
8C 210 END
B3 220 REM EQUATION
A6 230 ONERR GOTO 270
A6 240 Y = 900 / X
DD 250 E$ = "OFF": POKE 216,0: GOTO 290
4C 260 : REM INVALID X
B9 270 E$ = "ON"
30 280 POKE 216,0: CALL - 3288
24 290 RETURN
A6 300 REM INITIALIZE
48 310 : REM TITLE
41 320 GOSUB 400
FE 330 : REM INSTRUCTIONS
51 340 GOSUB 460
BC 350 : REM KEY VALUES
58 360 GOSUB 570
F9 370 : REM SHAPES
5D 380 GOSUB 670
25 390 RETURN
25 400 REM TITLE
28 410 PRINT CHR$ (21): TEXT : HOME
22 420 VTAB 12: HTAB 13: PRINT "CURVE PLOTTER"
7C 430 FOR PAUSE = 1 TO 1500: NEXT
8F 440 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
1E 450 RETURN
8A 460 REM INSTRUCTIONS
55 470 HOME
75 480 PRINT "THIS PROGRAM PLOTS A CURVE FOR YOU.":
PRINT
34 490 PRINT "IS THE EQUATION OF THE CURVE NOW IN"
D4 500 VTAB 4: HTAB 1: PRINT "LINE 240 OF THE PROGRA
M (Y/N) ? ";BELL$;
58 510 GET S$
CC 520 A = ASC (S$): IF A > 96 THEN A = A - 32
3D 530 S$ = CHR$ (A)
A4 540 IF S$ = "N" THEN VTAB 6: HTAB 1: PRINT "PLEAS
E PUT IT THERE, AND ";: INVERSE : PRINT "RUN"
;: NORMAL : PRINT " AGAIN.": STOP
37 550 IF S$ < > "Y" THEN GOTO 500
21 560 RETURN
6A 570 REM KEY VALUES
58 580 HOME
AB 590 VTAB 12: HTAB 16: PRINT "READING"
A0 600 : REM MENU OPTIONS
AF 610 DATA TALLY Y,CHANGE TIC INTERVALS,QUIT
39 620 FOR I = 1 TO 3: READ M$(I): NEXT
8F 630 : REM DELTA BETWEEN TIC MARKS
```

SCIENCE AND STATISTICS

```
11 640 DATA 25,25
59 650 READ XD,YD
22 660 RETURN
00 670 REM SHAPES
0A 680 : REM DIRECTORY
96 690 DATA 14,0,30,0,44,0,55,0,69,0,78,0,90,0,103,0
,114,0,127,0
6F 700 DATA 140,0,151,0,165,0,177,0,180,0
D3 710 : REM X & Y
E9 720 DATA 12,12,60,27,51,14,22,23,46,9,33,28,7,0
43 730 DATA 5,40,32,31,27,54,49,49,54,6,0
55 740 : REM 0 TO 9, & DECIMAL
A2 750 DATA 12,37,28,63,23,54,46,55,14,45,12,36,4,0
58 760 DATA 36,60,42,54,54,46,63,7,0
2A 770 DATA 45,32,28,63,23,22,17,23,46,45,37,0
C3 780 DATA 37,5,32,63,63,22,18,50,41,45,32,4,0
1A 790 DATA 33,36,23,23,23,46,45,61,54,6,0
7E 800 DATA 56,39,44,45,53,19,21,54,30,63,7,32,0
C4 810 DATA 45,50,30,63,7,32,44,39,12,12,45,6,0
4D 820 DATA 30,54,36,5,40,40,32,63,63,7,0
FA 830 DATA 45,50,30,63,7,32,12,28,36,41,45,50,6,0
18 840 DATA 39,35,12,45,21,54,47,54,51,59,63,0
5C 850 DATA 18,50,0
FA 860 : REM BOX
AC 870 DATA 36,36,45,53,54,54,54,62,36,36,36,60,54,5
4,54,62,63,39,36,36
25 880 DATA 36,44,53,55,53,55,53,53,62,39,37,63,0
F2 890 FOR I = 16384 TO 16596
A5 900 READ V
8D 910 POKE I,V
05 920 NEXT
9A 930 POKE 233,64: POKE 232,0
21 940 RETURN
DF 950 REM PLOT CURVE
AD 960 : REM AXES
EF 970 GOSUB 1070
E5 980 : REM BORDER & GRID
EB 990 GOSUB 1240
2D 1000 : REM NUMBERS
5B 1010 GOSUB 1340
8D 1020 : REM SCREEN COORDINATES
7F 1030 GOSUB 1660
97 1040 : REM CURVE
5B 1050 GOSUB 1700
E9 1060 RETURN
65 1070 REM AXES
4A 1080 HOME : HGR : HCOLOR= 3: ROT= 0: SCALE= 1
B7 1090 : REM Y
70 1100 HPLLOT 140,8 TO 140,152
87 1110 FOR I = 8 TO 152 STEP 18
```

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```
01 1120 HPlot 139,I TO 141,I
AF 1130 NEXT
86 1140 DRAW 14 AT 132,8
A4 1150 HCOLOR= 0: DRAW 2 AT 132,8: HCOLOR= 3
AC 1160 : REM X
46 1170 HPlot 20,80 TO 260,80
CF 1180 FOR I = 20 TO 260 STEP 30
10 1190 HPlot I,79 TO I,81
A5 1200 NEXT
8F 1210 DRAW 14 AT 267,80
7B 1220 HCOLOR= 0: DRAW 1 AT 267,80: HCOLOR= 3
E1 1230 RETURN
91 1240 REM BORDER & GRID
5C 1250 : REM BORDER
E6 1260 HPlot 0,0 TO 279,0: HPlot TO 279,159: HPlot
    TO 0,159: HPlot TO 0,0
1C 1270 HPlot 1,1 TO 278,1: HPlot TO 278,158: HPlot
    TO 1,158: HPlot TO 1,1
98 1280 : REM GRID
5D 1290 FOR X = 20 TO 260 STEP 30
8F 1300 FOR Y = 8 TO 152 STEP 18
2F 1310 HPlot X,Y
46 1320 NEXT Y,X
E3 1330 RETURN
84 1340 REM NUMBERS
F8 1350 : REM SCALE
CE 1360 X(1) = - 4 * XD:Y(1) = - 4 * YD
0E 1370 FOR I = 2 TO 9
7F 1380 X(I) = X(I - 1) + XD
96 1390 Y(I) = Y(I - 1) + YD
A9 1400 NEXT
12 1410 : REM Y AXIS
8C 1420 FOR I = 6 TO 8 STEP 2
89 1430 Y = 170 - 18 * I
90 1440 N$ = STR$ (Y(I)):L = LEN (N$):X = 138 - L *
    6
93 1450 GOSUB 1570
8B 1460 NEXT I
29 1470 : REM X AXIS
D4 1480 FOR I = 6 TO 8 STEP 2
2B 1490 N$ = STR$ (X(I)):L = LEN (N$)
8F 1500 Y = 87:X = - 10 + 30 * I:X = X - (L - 1) * 6
    / 2
85 1510 GOSUB 1570
7D 1520 NEXT I
21 1530 : REM ORIGIN
9B 1540 HCOLOR= 3: DRAW 14 AT 132,87
ED 1550 HCOLOR= 0: DRAW 3 AT 132,87: HCOLOR= 3
F3 1560 RETURN
E6 1570 REM DRAW NUMBER
```

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```
C5 1580 FOR J = 1 TO L
69 1590 HCOLOR= 3: DRAW 14 AT X,Y
EB 1600 A = ASC ( MID$ (N$,J,1))
C7 1610 S = A - 45
I3 1620 IF A = 46 THEN S = 13
43 1630 HCOLOR= 0: DRAW S AT X,Y:X = X + 6
88 1640 NEXT J
F1 1650 RETURN
71 1660 REM ACTUAL-TO-SCREEN COORDINATES
72 1670 DEF FN Y(V) = 80 - (18 / YD) * V
D0 1680 DEF FN X(V) = 140 + (30 / XD) * V
02 1690 RETURN
59 1700 REM PLOT CURVE
E0 1710 DL = (X(9) - X(1)) / 200
54 1720 HLD$ = "OFF"
FC 1730 FOR X = X(1) TO X(9) STEP DL
1E 1740 GOSUB 220: REM COMPUTE Y
C4 1750 X1 = FN X(X):Y1 = FN Y(Y)
36 1760 IF E$ = "ON" OR (Y1 < 8 OR Y1 > 156) THEN HL
    D$ = "OFF": GOTO 1800
7E 1770 IF HLD$ = "ON" THEN HPLOT HX,HY TO X1,Y1
F3 1780 IF HLD$ < > "ON" THEN HPLOT X1,Y1
D3 1790 HX = X1:HY = Y1:HLD$ = "ON"
B1 1800 NEXT
E5 1810 RETURN
1B 1820 REM CHOOSE FROM MENU
A2 1830 : REM CHOICES
97 1840 GOSUB 1950
E6 1850 : REM CHOOSE
69 1860 VTAB 24: HTAB 17: INVERSE : PRINT "OPTION:";
    : NORMAL : PRINT CHR$ (32);:CLICK = PEEK (Z)
80 1870 GET S$
69 1880 A = ASC (S$): IF A > 96 THEN A = A - 32
CB 1890 PICK = 0
1D 1900 IF A = 84 THEN PICK = 1
2D 1910 IF A = 67 THEN PICK = 2
2F 1920 IF A = 81 THEN PICK = 3
A2 1930 IF PICK = 0 THEN 1860
F3 1940 RETURN
41 1950 REM CHOICES
4D 1960 GOSUB 2030: REM CLEAR LINES
3C 1970 VTAB 22: HTAB 2
BB 1980 FOR I = 1 TO 3
22 1990 INVERSE : PRINT LEFT$ (M$(I),1);: NORMAL
AC 2000 PRINT MID$ (M$(I),2); SPC( 3);
A6 2010 NEXT
DA 2020 RETURN
0A 2030 REM CLEAR LINES
C5 2040 VTAB 22: HTAB 1: PRINT SPC( 39)
45 2050 VTAB 24: HTAB 1: PRINT SPC( 39);
```


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```
EA 2060 RETURN
37 2070 REM TALLY Y
44 2080 GOSUB 2030: REM CLEAR LINES
7E 2090 VTAB 22: HTAB 14: INPUT "VALUE OF X ? ";X$
8E 2100 X = VAL (X$): GOSUB 220
4C 2110 GOSUB 2030
2A 2120 VTAB 22: HTAB 1: PRINT "FOR ";: INVERSE : PR
      INT "X";: NORMAL : PRINT " = ";X;": ", "I
43 2130 INVERSE : PRINT "Y";: NORMAL
18 2140 IF E$ = "OFF" THEN PRINT " = "; INT (Y * 100
      + .5) / 100
6C 2150 IF E$ = "ON" THEN PRINT " IS UNDEFINED."
7F 2160 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
73 2170 GET S$
F4 2180 RETURN
F7 2190 REM CHANGE AXIS INCREMENTS
A0 2200 DL$(1) = "X":DL$(2) = "Y"
37 2210 : REM ENTER VALUES
86 2220 FOR I = 1 TO 2
86 2230 GOSUB 2280
80 2240 NEXT I
FF 2250 : REM PLOT CURVE
61 2260 GOSUB 950
F2 2270 RETURN
47 2280 REM ENTER DELTA
6E 2290 GOSUB 2030
4B 2300 VTAB 22: HTAB 13: INVERSE : PRINT DL$(I);"-A
      XIS INTERVAL:";: NORMAL : PRINT SPC( 15):CLI
      CK = PEEK (Z)
C2 2310 VTAB 22: HTAB 29: INPUT " ";S$
47 2320 DL = VAL (S$)
0E 2330 IF DL < 0.1 THEN VTAB 24: HTAB 16: PRINT "TO
      O SMALL !";: GOTO 2300
53 2340 IF DL > 200000 THEN VTAB 24: HTAB 16: PRINT
      "TOO LARGE !";: GOTO 2300
60 2350 IF I = 1 THEN XD = DL
85 2360 IF I = 2 THEN YD = DL
F4 2370 RETURN
```

CHEMISTRY BASICS

Radium is dangerously radioactive, was discovered in 1898 by Pierre and Marie Curie, and weighs 1783.3 percent more than carbon. Barium is used to coat the stomach for x-rays, gives fireworks a green color, and has a melting point of 714 degrees Celsius (1317 degrees Fahrenheit). These are a few of the items that you'll have at your fingertips in "Chemistry Basics," a program that lets you review and analyze a wealth of intriguing information on the earth's 103 elements.

An element, incidentally, is a unique building block in nature which can't be reduced into a more basic substance through chemical means. There are 88 natural elements and 15 artificial ones. Together they form compounds which make up all the objects on the earth. Two-thirds of the human body, by the way, is the element oxygen.

Chemistry Basics is what computer scientists call a table-lookup program. It enables you to view a family of elements, view an element in detail, and sort the elements.

An example of the first option is a display of the six inert gases of Figure 7-4. If you'd like the full names of these elements, that's no problem. Just follow the Apple's prompts when you run the program.

Figure 7-4. The Six Inert Gases

(02)	(10)	(18)	(36)	(54)	(86)
HE	NE	AR	KR	XE	RN

In the second option you can select an element by its symbol, number, or name. *H*, *1*, and *Hydrogen*, for example, all represent the same element. Figure 7-5 is a closer look at hydrogen.

The third option lets you sort elements by atomic number, atomic weight, boiling point, melting point, density, and year of discovery. If you experiment with this function, you'll learn, among other things, that carbon possesses the highest known melting point of all the elements (3727 degrees Celsius) and that hydrogen is the lightest element.

Figure 7-5. Facts About Hydrogen

UP CLOSE AND PERSONAL

Boiling Point : -252.7 Celsius
Melting Point : -259.2 Celsius
Density : 0.071 Grams/Milliliter

(1)

HYDROGEN (H)

- Lightest element
- The sun and stars are almost pure hydrogen
- Discovered in 1766
- One (H) atom weighs 91.6% less than one carbon atom

Finally, you may want to use Chemistry Basics for playing games. For example, try to recall which elements belong in which families, or which element is lightest, densest, or has the lowest boiling point. You could try to figure out which elements are used in jet aircraft engines because of their great resistance to heat. You'll find that Chemistry Basics trivia games can be much more fun than staring at a dull table in a textbook.

When you run the program, the Apple will prompt you for the number of an element. Type it in, and the Apple will respond with the element's name. For example, (36) is krypton.

Basic Chemistry Terms

This short list of definitions will get you started on your way with Chemistry Basics.

Atom. From the Greek word *atoma* (indivisible). The smallest part of an element. An atom consists of protons, neutrons, and electrons. The protons and neutrons dwell in a nucleus, and the electrons hover about.

Atomic number. The number of protons in the nucleus of an atom and consequently the numeric value assigned to the corresponding element. An atom of tin, for example, contains 50 protons; hence, the atomic number for tin is 50.

Atomic weight. The weight of an atom of an element relative to that of an atom of carbon, which has a weight of 12.011. Hence, an aluminum atom with an atomic weight of

26.982 is slightly more than twice the weight of a carbon atom.

Density. The mass of a substance per unit of volume. In Chemistry Basics, the density of an element is measured in grams per milliliter (a metric measure).

Element. A unique building block in nature which can't be reduced into a more basic substance through chemical means.

Chemistry Basics Database

This program creates a data file on disk for the Chemistry Basics program to run. When you type in the program, a good strategy is to take a break after every 20 or 30 elements, since taking short breaks will cut down on mistakes.

Run Program 7-6A first and only once. Then, whenever you want to use Chemistry Basics, just run Program 7-6B. You don't have to run Program 7-6A again.

Program 7-6A. Chemistry Basics Database

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
10 100 REM CHEMISTRY DATA BASE
F8 110 : REM INSTRUCTIONS
4A 120 GOSUB 170
CC 130 : REM CREATE FILE
4F 140 GOSUB 270
32 150 HOME : PRINT "YOUR FILE IS SAVED."
93 160 END
89 170 REM INSTRUCTIONS
33 180 PRINT CHR$(21): TEXT : HOME
F8 190 PRINT "THIS PROGRAM CREATES A DATA BASE FOR"
E1 200 PRINT
7E 210 PRINT "USE IN ";: INVERSE : PRINT "CHEMISTRY
    BASICS";: NORMAL : PRINT "."
5E 220 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
59 230 GET S$
6D 240 N = 103
0B 250 DIM SYM$(N), NM$(N), X(N,5), CM$(N,2)
1E 260 RETURN
72 270 REM CREATE FILE
29 280 : REM READ DATA
4C 290 HOME : VTAB 12: HTAB 16: PRINT "READING"
46 300 GOSUB 350
79 310 : REM SAVE
8D 320 VTAB 12: HTAB 16: PRINT " SAVING"
51 330 GOSUB 470
```

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```
1B 340 RETURN
71 350 REM READ
D3 360 FOR I = 1 TO N
4E 370 : REM SYMBOL,NAME
82 380 READ SYM$(I),NM$(I)
7E 390 : REM ATOMIC WEIGHT, BOILING & MELTING POINTS
, DENSITY , YEAR OF DISCOVERY
40 400 FOR J = 1 TO 5
83 410 READ X(I,J)
65 420 NEXT J
92 430 : REM ONE-LINERS
D3 440 READ CM$(I,1),CM$(I,2)
EA 450 NEXT I
20 460 RETURN
CB 470 REM SAVE
F1 480 D$ = CHR$(4):FILE$ = "ELEMENTS"
0A 490 PRINT D$;"OPEN" + FILE$
95 500 PRINT D$;"WRITE" + FILE$
CB 510 FOR I = 1 TO N
7E 520 PRINT SYM$(I);",";NM$(I)
47 530 FOR J = 1 TO 5
85 540 PRINT X(I,J)
6C 550 NEXT J
7D 560 PRINT CM$(I,1);",";CM$(I,2)
EF 570 NEXT I
C5 580 PRINT D$;"CLOSE"
27 590 RETURN
E5 600 REM ELEMENT DATA (9999=UNKNOWN)
E9 610 DATA H, HYDROGEN, 1.008, -252.7, -259.2, 0.071, 176
6
2C 620 DATA LIGHTEST ELEMENT, THE SUN & STARS ARE AL
MOST PURE HYDROGEN
9D 630 DATA HE, HELIUM, 4.0026, -268.9, -269.7, 0.126, 186
8
A3 640 DATA LIGHTER THAN AIR, USED IN BLIMPS & BALLO
ONS
25 650 DATA LI, LITHIUM, 6.939, 1330, 108.5, 0.53, 1817
38 660 DATA FROM 'LITHOS' OR STONE, USED IN TREATING
GOUT & DEPRESSION
D2 670 DATA BE, BERYLLIUM, 9.0122, 2770, 1277, 1.85, 1798
28 680 DATA NOTE HIGH MELTING POINT, USED IN MAKING
ROCKET NOSE CONES
37 690 DATA B, BORON, 10.811, 9999, 2030, 2.34, 1808
21 700 DATA SERVES AS PLANT FOOD & WEED KILLER, FROM
BOR(AX) & (CARB)ON
1C 710 DATA C, CARBON, 12.011, 4830, 3727, 2.26, 9999
F4 720 DATA USED IN ENDLESS PRODUCTS (EG- NYLON), FO
UND IN ALL ORGANIC SUBSTANCES
44 730 DATA N, NITROGEN, 14.007, -195.8, -210, 0.81, 1772
```


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- 69 740 DATA "ODORLESS, COLORLESS, GASEOUS", COMPOUNDS INCLUDE TNT & LAUGHING GAS
- 4F 750 DATA O, OXYGEN, 15.999, -183, -218.8, 1.14, 1774
- 25 760 DATA THE MOST ABUNDANT ELEMENT, MAKES UP 2/3 OF THE HUMAN BODY
- FD 770 DATA F, FLUORINE, 18.998, -188.2, -219.6, 1.11, 1771
- CE 780 DATA "PALE, GREENISH-YELLOW, PUNGENT", IT CORRODES EVEN TOUGH PLATINUM
- 41 790 DATA NE, NEON, 20.183, -246, -248.6, 1.2, 1898
- BE 800 DATA FAMOUS IN ELECTRICAL DISPLAY SIGNS, GIVES OFF ORANGE-RED LIGHT
- BD 810 DATA NA, SODIUM, 22.990, 892, 97.8, 0.97, 1807
- 19 820 DATA SILVER-WHITE & HIGHLY REACTIVE, USEFUL COMPOUNDS INCLUDE TABLE SALT
- ED 830 DATA MG, MAGNESIUM, 24.312, 1107, 650, 1.74, 1775
- DD 840 DATA FROM MAGNESIA IN ANCIENT ASIA MINOR, USED AS A POWDER IN FIRECRACKERS
- 17 850 DATA AL, ALUMINUM, 26.982, 2450, 660, 2.7, 1827
- 35 860 DATA MOST ABUNDANT METAL, WIDELY USED IN ALLOYS
- AA 870 DATA SI, SILICON, 28.086, 2680, 1410, 2.33, 1823
- 98 880 DATA 2ND MOST ABUNDANT ELEMENT, MAKES UP 1/4 OF THE EARTH'S CRUST
- 9A 890 DATA P, PHOSPHORUS, 30.974, 280, 44.2, 1.82, 1669
- B7 900 DATA GLOWS IN THE DARK, HIGHLY FLAMMABLE
- FB 910 DATA S, SULFUR, 32.064, 444.6, 119, 2.07, 9999
- BC 920 DATA PALE YELLOW & NONMETALLIC, USED IN MATCHES & GUNPOWDER
- 29 930 DATA CL, CHLORINE, 35.453, -34.7, -101, 1.56, 1774
- 13 940 DATA A GREENISH-YELLOW POISON, USED AS A BLEACH & DISINFECTANT
- EB 950 DATA AR, ARGON, 39.948, -185.8, -189.4, 1.4, 1894
- 11 960 DATA MOST ABUNDANT OF THE NOBLE GASES, USED IN INCANDESCENT LAMPS
- BA 970 DATA K, POTASSIUM, 39.102, 760, 63.7, 0.86, 1807
- 4E 980 DATA 7TH MOST ABUNDANT ELEMENT, YIELDS MANY VALUABLE COMPOUNDS
- FI 990 DATA CA, CALCIUM, 40.08, 1440, 838, 1.55, 1808
- DA 1000 DATA VITAL TO HEALTHY TEETH & BONES, FOUND WITH CHALK & LIMESTONE
- 9B 1010 DATA SC, SCANDIUM, 44.956, 2730, 1539, 3, 1879
- 7B 1020 DATA FROM SCANDINAVIA, OF LITTLE PRACTICAL USE
- 27 1030 DATA TI, TITANIUM, 47.9, 3260, 1668, 4.51, 1791
- 76 1040 DATA LIGHTWEIGHT YET STRONG, USED IN JET AIRCRAFT
- BF 1050 DATA V, VANADIUM, 50.942, 3450, 1900, 6.1, 1830
- 5B 1060 DATA VERY TOUGH WHEN ADDED TO STEEL, USED IN AXLES & PISTON RODS

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- CF 1070 DATA CR, CHROMIUM, 51.996, 2665, 1875, 7.19, 1797
 4E 1080 DATA FORMS TOUGH ALLOYS, CHROME PLATE ON CAR
 S
 90 1090 DATA MN, MANGANESE, 54.938, 2150, 1245, 7.43, 1774
 95 1100 DATA ADDS TOUGHNESS TO BONES, HELPS HARDEN S
 TEEL
 D3 1110 DATA FE, IRON, 55.847, 3000, 1536, 7.86, 9999
 29 1120 DATA FROM THE OLD ENGLISH 'IREN', USED BY EA
 RLY MAN
 B7 1130 DATA CO, COBALT, 58.933, 2900, 1495, 8.9, 1735
 96 1140 DATA FROM 'KOBOLD' OR EVIL SPIRIT, ALLOYS US
 ED IN JET ENGINES
 61 1150 DATA NI, NICKEL, 58.71, 2730, 1453, 8.9, 1751
 E2 1160 DATA HARD & DURABLE, USED IN COINS & PLATING
 7C 1170 DATA CU, COPPER, 63.54, 2595, 1083, 8.96, 9999
 E1 1180 DATA GREAT CONDUCTOR OF HEAT & ELECTRICITY,
 ALSO USED IN THE ARTS
 5C 1190 DATA ZN, ZINC, 65.37, 906, 419.5, 7.14, 9999
 21 1200 DATA EXCELLENT COATING METAL, USED IN BATTER
 IES
 C4 1210 DATA GA, GALLIUM, 69.72, 2237, 29.8, 5.91, 1875
 5B 1220 DATA MELTS IN THE HAND (86 F.), EXPANDS AS I
 T FREEZES
 FD 1230 DATA GE, GERMANIUM, 72.59, 2830, 937.4, 5.32, 1886
 BF 1240 DATA NAMED FOR GERMANY, 1ST ELEMENT USED FOR
 TRANSISTORS
 C3 1250 DATA AS, ARSENIC, 74.922, 613, 817, 5.72, 1250
 10 1260 DATA FAMED AS POISON, USED IN MEDICINE
 F4 1270 DATA SE, SELENIUM, 78.96, 685, 217, 4.79, 1817
 5F 1280 DATA ITS ELECTRICAL RESISTANCE VARIES WITH L
 IGH, USED IN TV CAMERAS
 06 1290 DATA BR, BROMINE, 79.909, 58, -7.2, 3.12, 1826
 BB 1300 DATA REDDISH BROWN WITH FOUL SMELL, FROM 'BR
 OMOS' OR STENCH
 68 1310 DATA KR, KRYPTON, 83.8, -152, -157.3, 2.6, 1898
 BD 1320 DATA A BY-PRODUCT OF NUCLEAR REACTORS, HELPS
 US TRACK SOVIET ATOMIC PRODUCTION
 7D 1330 DATA RB, RUBIDIUM, 85.47, 688, 38.9, 1.53, 1861
 27 1340 DATA SLIGHTLY RADIOACTIVE, USED TO LOCATE BR
 AIN TUMORS
 64 1350 DATA SR, STRONTIUM, 87.62, 1380, 768, 2.6, 1790
 75 1360 DATA PRESENT IN ATOMIC FALLOUT, DESTROYS BON
 E MARROW
 2E 1370 DATA Y, YTTRIUM, 88.905, 2927, 1509, 4.47, 1794
 F4 1380 DATA FROM YTTIRBY IN SWEDEN, USED IN SURGICA
 L NEEDLES
 B5 1390 DATA ZR, ZIRCONIUM, 91.22, 3580, 1852, 6.49, 1780
 27 1400 DATA UNAFFECTED BY NEUTRONS, USED AS INNER L
 INING FOR NUCLEAR REACTORS
 34 1410 DATA NB, NIOBIUM, 92.906, 3300, 2415, 8.4, 1801

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- 84 1420 DATA FROM 'NIOBE' OF GREEK MYTH, USED IN JET
ENGINES & ROCKETS
- 44 1430 DATA MO, MOLYBDENUM, 95.94, 5560, 2610, 10.2, 1778
- E1 1440 DATA 5TH HIGHEST-MELTING METAL, USED IN RIFL
E BARRELS
- FD 1450 DATA TC, TECHNETIUM, 99, 9999, 2200, 11.5, 1937
- 31 1460 DATA 1ST. MAN-MADE ELEMENT, A FISSION PRODUCT
OF URANIUM
- F0 1470 DATA RU, RUTHENIUM, 101.07, 4900, 2500, 12.2, 1844
- 98 1480 DATA FROM THE LATIN 'RUTHENIA' OR RUSSIA, A
FIRST-CLASS HARDENER
- 47 1490 DATA RH, RHODIUM, 102.905, 4500, 1966, 12.4, 1803
- 56 1500 DATA FROM 'RHODON' OR ROSE, USED IN ELECTROP
LATING
- B6 1510 DATA PD, PALLADIUM, 106.4, 3980, 1552, 12, 1803
- DB 1520 DATA CORROSION RESISTANT, USED IN SURGICAL I
NSTRUMENTS
- A4 1530 DATA AG, SILVER, 107.87, 2210, 960.8, 10.5, 9999
- CA 1540 DATA FROM OLD ENGLISH 'SEOLFOR', BEST CONDUCTOR
OF HEAT & ELECTRICITY
- 1B 1550 DATA CD, CADMIUM, 112.4, 765, 320.9, 8.65, 1817
- SD 1560 DATA FOUND IN ZINC ORES, USED TO CONTROL ATOM
IC FISSION
- 9D 1570 DATA IN, INDIUM, 114.82, 2000, 156.2, 7.31, 1863
- 20 1580 DATA RARE, SOFT & MALLEABLE
- 0B 1590 DATA SN, TIN, 118.69, 2270, 231.9, 7.3, 9999
- CB 1600 DATA DOES NOT RUST OR CORRODE, USED TO COAT
CANS
- 7F 1610 DATA SB, ANTIMONY, 121.75, 1380, 630.5, 6.62, 1450
- AD 1620 DATA "SILVER-WHITE, HARD, CRYSTALLINE", USED
IN CHEMISTRY & THE ARTS
- BD 1630 DATA TE, TELLURIUM, 127.6, 989.8, 449.5, 6.24, 178
2
- F0 1640 DATA FROM 'TELLUS' OR EARTH, ITS VAPOR SMACK
S OF GARLIC
- 88 1650 DATA I, IODINE, 126.9, 183, 113.7, 4.94, 1811
- 78 1660 DATA FAMOUS AS AN ANTISEPTIC, SUPPLEMENTS THE
HUMAN DIET
- 56 1670 DATA XE, XENON, 131.3, -108, -111.9, 3.06, 1898
- 06 1680 DATA RAREST GAS IN THE ATMOSPHERE, PRODUCES
AN INTENSE LIGHT
- 88 1690 DATA CS, CESIUM, 132.905, 690, 28.7, 1.9, 1860
- AA 1700 DATA THE SOFTEST METAL, LIQUID AT ROOM TEMPER
ATURE
- 35 1710 DATA BA, BARIUM, 137.34, 1640, 714, 3.5, 1808
- 78 1720 DATA USED TO COAT STOMACH FOR X-RAYS, GIVES
FIREWORKS A GREEN COLOR
- 85 1730 DATA LA, LANTHANUM, 138.91, 3470, 920, 6.17, 1839
- C9 1740 DATA DARK LEAD-GRAY, USED IN HIGH-PRICED CAM
ERA LENSES

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- BD 1750 DATA CE, CERIUM, 140.12, 3468, 795, 6.67, 1803
- 58 1760 DATA MOST ABUNDANT OF RARE-EARTH ELEMENTS, USED IN ALLOYS FOR JET-ENGINE PARTS
- AA 1770 DATA PR, PRASEODYMIUM, 140.91, 3127, 935, 6.77, 1885
- 7C 1780 DATA YELLOWISH WHITE, USED IN GOGGLES FOR GLASS BLOWING
- 35 1790 DATA ND, NEODYMIUM, 144.24, 3027, 1024, 7, 1885
- 1E 1800 DATA FORMS THE ONLY BRIGHT-PURPLE GLASS KNOWN, AND USED TO TAKE COLOR OUT OF GLASS
- CF 1810 DATA PM, PROMETHIUM, 147, 9999, 1027, 9999, 1947
- 5C 1820 DATA USED IN ATOMIC BATTERIES, NAMED FOR PROMETHEUS
- 9A 1830 DATA SM, SAMARIUM, 150.35, 1900, 1072, 7.54, 1879
- 5D 1840 DATA "HARD, BRITTLE, YELLOWISH GRAY", USED IN LASERS
- D9 1850 DATA EU, EUROPIUM, 151.96, 1439, 826, 5.26, 1896
- 58 1860 DATA MOST REACTIVE OF THE RARE EARTHS, USED IN ATOMIC-REACTOR CONTROL RODS
- C9 1870 DATA GD, GADOLINIUM, 157.25, 3000, 1312, 7.89, 1880
- 6D 1880 DATA NAMED FOR JOHN GADOLIN- CHEMIST, DIVIDES LIGHTWEIGHT RARE EARTHS FROM HEAVY
- 85 1890 DATA TB, TERBIUM, 158.92, 2800, 1356, 8.27, 1843
- 58 1900 DATA FROM YTTERBY IN SWEDEN, BURSTS INTO FLAME WHEN HEATED
- 1C 1910 DATA DY, DYSPROSIUM, 162.5, 2600, 1407, 8.54, 1886
- 72 1920 DATA HIGHLY MAGNETIC, USED TO 'EAT' NEUTRONS
- D5 1930 DATA HO, HOLMIUM, 164.93, 2600, 1461, 8.80, 1879
- 87 1940 DATA LATINIZED NAME OF STOCKHOLM, USED TO ABSORB NEUTRONS
- 30 1950 DATA ER, ERBIUM, 167.26, 2900, 1497, 9.05, 1843
- C1 1960 DATA FROM YTTERBY IN SWEDEN, USED FOR PINK GLAZE IN CERAMICS
- A1 1970 DATA TM, THULIUM, 168.93, 1727, 1545, 9.33, 1879
- 12 1980 DATA FROM 'THULE' OR NORTHLAND, GIVES OFF X-RAYS
- 98 1990 DATA YB, YTTERBIUM, 173.04, 1427, 824, 6.98, 1907
- 40 2000 DATA FROM YTTERBY IN SWEDEN, "RARE, & OF LITTLE PRACTICAL USE"
- 92 2010 DATA LU, LUTETIUM, 174.97, 3327, 1652, 9.84, 1907
- 21 2020 DATA HEAVIEST OF THE RARE EARTHS, "EXPENSIVE, NO PRACTICAL USE"
- 85 2030 DATA HF, HAFNIUM, 178.49, 5400, 2222, 13.1, 1923
- 2D 2040 DATA WONDER METAL OF THE ATOMIC AGE, ABSORBS NEUTRONS
- 82 2050 DATA TA, TANTALUM, 180.948, 5425, 2996, 16.6, 1802
- 87 2060 DATA ALMOST IMMUNE TO CORROSION, VITAL IN HUMAN SURGERY
- 48 2070 DATA W, TUNGSTEN, 183.85, 5930, 3410, 19.3, 1783

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- 5B 2080 DATA HIGHEST MELTING OF METALS, USED IN HIGH-SPEED DENTAL DRILLS
- 1F 2090 DATA RE, RHENIUM, 186.2, 5900, 3180, 21, 1925
- 2E 2100 DATA 2ND HIGHEST MELTING POINT, USED IN ELECTRICAL CONTACT POINTS
- 87 2110 DATA OS, OSMIUM, 190.2, 5500, 2700, 22.6, 1804
- 6A 2120 DATA WORLD'S DENSEST METAL, USED TO PRODUCE VERY HARD ALLOYS
- 66 2130 DATA IR, IRIIDIUM, 192.2, 5300, 2454, 22.5, 1804
- FA 2140 DATA A VERY HARD METAL, USED IN STANDARD WEIGHTS/MEASURES
- 23 2150 DATA PT, PLATINUM, 195.09, 4530, 1769, 21.4, 9999
- 51 2160 DATA FROM PLATINA OR 'LITTLE SILVER', USED IN JEWELRY
- DD 2170 DATA AU, GOLD, 196.97, 2970, 1063, 19.3, 9999
- 48 2180 DATA THE MOST MALLEABLE METAL, COSTS \$HUNDREDS PER OUNCE
- DC 2190 DATA HG, MERCURY, 200.59, 357, -38.4, 13.6, 9999
- E8 2200 DATA USED IN THERMOMETERS, LIQUID AT ORDINARY TEMPERATURES
- 86 2210 DATA TL, THALLIUM, 204.37, 1457, 303, 11.85, 1861
- E9 2220 DATA ODORLESS & TASTELESS, ITS SALTS ARE USED IN RAT POISON
- 81 2230 DATA PB, LEAD, 207.19, 1725, 327.4, 11.4, 9999
- 86 2240 DATA VERY DURABLE, USED BY ROMANS FOR PLUMBING
- 77 2250 DATA BI, BISMUTH, 208.98, 1560, 271.3, 9.8, 9999
- 81 2260 DATA LUSTROUS & REDDISH WHITE, USED IN MEDICINE & MAKEUP
- A8 2270 DATA PO, POLONIUM, 210, 9999, 254, 9.2, 1898
- FF 2280 DATA NAMED FOR POLAND, THE SCARCEST NATURAL ELEMENT
- D3 2290 DATA AT, ASTATINE, 210, 9999, 302, 9999, 1940
- 24 2300 DATA RADIOACTIVE, MAXIMUM HALF LIFE IS 8 HOURS
- 8E 2310 DATA RN, RADON, 222, -61.8, -71, 9999, 1900
- 1E 2320 DATA HEAVIEST GASEOUS ELEMENT, USED IN CANCER THERAPY
- 5C 2330 DATA FR, FRANCIUM, 223, 9999, 27, 9999, 1939
- D7 2340 DATA FOR FRANCE, DISCOVERED BY ONE OF MARIE CURIE'S HELPERS
- A7 2350 DATA RA, RADIUM, 226, 9999, 700, 5, 1898
- B1 2360 DATA DANGEROUSLY RADIOACTIVE, FOUND BY PIERRE & MARIE CURIE
- 3E 2370 DATA AC, ACTINIUM, 227, 9999, 1050, 9999, 1899
- 26 2380 DATA 2ND RAREST ELEMENT, FOUND IN PITCHBLEND
- E
- A8 2390 DATA TH, THORIUM, 232.04, 3850, 1750, 11.7, 1828
- C8 2400 DATA FROM THE WAR GOD 'THOR', USED TO GENERATE ATOMIC ENERGY

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89 2410 DATA PA, PROTACTINUM, 231, 9999, 1230, 15.4, 1917
C4 2420 DATA 3RD RAREST ELEMENT, RADIOACTIVE & METAL
LIC
80 2430 DATA U, URANIUM, 238.03, 3818, 1132, 19.07, 1789
27 2440 DATA NAMED AFTER THE PLANET URANUS, USED TO
GENERATE ATOMIC ENERGY
14 2450 DATA NP, NEPTUNIUM, 237, 9999, 637, 19.5, 1940
C3 2460 DATA NAMED AFTER THE PLANET NEPTUNE, ARTIFIC
IALLY PRODUCED FROM URANIUM
36 2470 DATA PU, PLUTONIUM, 242, 3235, 640, 9999, 1940
A8 2480 DATA NAMED AFTER THE PLANET PLUTO, USED IN T
HE FIRST ATOMIC BOMBS
47 2490 DATA AM, AMERICIUM, 243, 9999, 9999, 11.7, 1944
B5 2500 DATA UNSTABLE & RADIOACTIVE, PRODUCED BY BOM
BARDING PLUTONIUM
E3 2510 DATA CM, CURIUM, 247, 9999, 9999, 9999, 1944
C3 2520 DATA NAMED FOR PIERRE & MARIE CURIE, A DECAY
PRODUCT OF AMERICIUM
69 2530 DATA BK, BERKELIUM, 247, 9999, 9999, 9999, 1949
6F 2540 DATA NAMED AFTER BERKELEY CALIF., UNSTABLE &
RADIOACTIVE
E5 2550 DATA CF, CALIFORNIUM, 249, 9999, 9999, 9999, 1950
8A 2560 DATA NAMED FOR THE STATE, PRODUCED BY BOMBAR
DING CURIUM
7F 2570 DATA ES, EINSTEINIUM, 254, 9999, 9999, 9999, 1952
35 2580 DATA NAMED FOR ALBERT EINSTEIN, FOUND IN 195
2 H-BOMB TEST DEBRIS
17 2590 DATA FM, FERMIUM, 253, 9999, 9999, 9999, 1953
26 2600 DATA NAMED FOR ENRICO FERMI, PRODUCED BY BOM
BARDING EINSTEINIUM
8B 2610 DATA MD, MENDELEVIUM, 256, 9999, 9999, 9999, 1955
0B 2620 DATA AFTER INVENTOR OF THE PERIODIC TABLE, S
HORT-LIVED & RADIOACTIVE
1D 2630 DATA NO, NOBELIUM, 254, 9999, 9999, 9999, 1957
48 2640 DATA NAMED FOR ALFRED NOBLE, UNSTABLE & RADI
OACTIVE
81 2650 DATA LW, LAWRENCIUM, 257, 9999, 9999, 9999, 1961
20 2660 DATA NAMED FOR THE U.S. PHYSICIST, LATEST OF
THE ARTIFICIAL ELEMENTS

Program 7-6B. Chemistry Basics

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

6A 100 REM CHEMISTRY BASICS
4B 110 : REM INITIALIZE
4E 120 GOSUB 190
59 130 : REM CHOOSE FROM MENU
D9 140 GOSUB 1050
7A 150 ON PICK GOSUB 1160, 1940, 3180

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```
0E 160 IF PICK < > 4 THEN 140
AE 170 HOME : PRINT "BYE-BYE"
99 180 END
B6 190 REM INITIALIZE
45 200 : REM TITLE
4A 210 GOSUB 270
FB 220 : REM INSTRUCTIONS
45 230 GOSUB 320
B9 240 : REM KEY VALUES
46 250 GOSUB 400
1E 260 RETURN
31 270 REM TITLE
34 280 PRINT CHR$ (21): TEXT : HOME
79 290 VTAB 12: HTAB 12: PRINT "CHEMISTRY BASICS"
75 300 FOR PAUSE = 1 TO 1500: NEXT
15 310 RETURN
B1 320 REM INSTRUCTIONS
4C 330 HOME
0A 340 PRINT "THIS PROGRAM ENABLES YOU TO REVIEW AND
": PRINT
82 350 PRINT "ANALYZE A WEALTH OF INTRIGUING INFORMA
-": PRINT
23 360 PRINT "TION ON THE EARTH'S 103 BASIC ELEMENTS
"
69 370 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
64 380 GET S$
25 390 RETURN
5B 400 REM KEY VALUES
49 410 HOME
99 420 VTAB 12: HTAB 16: PRINT "READING"
4F 430 N = 103:K = 10
2F 440 DIM SYM$(N),NM$(N),X(N,5),CM$(N,2),FM$(K + 1)
,NF(K),FE(K,15),R(K),C(K),SV(N)
91 450 BELL$ = CHR$ (7):Z = - 16336: REM CLICK
45 460 L$ = "": FOR I = 1 TO 40:L$ = L$ + CHR$ (61):
NEXT
A0 470 : REM FAMILY NAMES
5B 480 GOSUB 560
BB 490 : REM ATOMIC NUMBER OF FAMILY ELEMENTS
53 500 GOSUB 690
A3 510 : REM MENU OPTIONS
51 520 GOSUB 850
6E 530 : REM ELEMENT DETAILS
50 540 GOSUB 920
1F 550 RETURN
D7 560 REM FAMILY NAMES
91 570 : REM NAMES
6A 580 DATA ALKALI & ALKALINE EARTHS,FIRST TRANSITIO
N METALS,THE TRIADS
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CD 590 DATA THIRD TRANSITION METALS,BORON & CARBON F
    AMILIES,NITROGEN & OXYGEN FAMILIES,HYDROGEN &
    THE HALOGENS
86 600 DATA THE INERT GASES,THE RARE EARTHS,ACTINIDE
    METALS,NONE
81 610 FOR I = 1 TO K + 1: READ FM$(I): NEXT
99 620 : REM ROWS & COLUMNS IN EACH
6B 630 DATA 2,6,3,5,3,3,2,3,2,5,2,5,1,6,1,6,3,5,3,5
8A 640 FOR I = 1 TO K
8B 650 READ R(I),C(I)
CC 660 NF(I) = R(I) * C(I)
0C 670 NEXT
26 680 RETURN
E8 690 REM ATOMIC NUMBER OF FAMILY ELEMENTS
71 700 DATA 3,11,19,37,55,87,4,12,20,38,56,88
5C 710 DATA 21,22,23,24,25,39,40,41,42,43,72,73,74,7
    5,0: REM 0 IS A DUMMY VALUE
46 720 DATA 26,44,76,27,45,77,28,46,78
C7 730 DATA 29,47,79,30,48,80
05 740 DATA 5,13,31,49,81,6,14,32,50,82
AF 750 DATA 7,15,33,51,83,8,16,34,52,84
D5 760 DATA 1,9,17,35,53,85
1C 770 DATA 2,10,18,36,54,86
87 780 DATA 57,58,59,60,61,62,63,64,65,66,67,68,69,7
    0,71
01 790 DATA 89,90,91,92,93,94,95,96,97,98,99,100,101
    ,102,103
84 800 FOR I = 1 TO K
D7 810 FOR J = 1 TO NF(I)
26 820 READ FE(I,J)
AB 830 NEXT J,I
20 840 RETURN
DF 850 REM MENU OPTIONS
8D 860 DATA VIEW A FAMILY OF ELEMENTS,VIEW AN ELEMEN
    T IN DETAIL,SORT THE ELEMENTS,EXIT
0F 870 FOR I = 1 TO 4: READ MM$(I): NEXT
CE 880 : REM SORT
5B 890 DATA ATOMIC NUMBER,ATOMIC WEIGHT,BOILING POIN
    T,MELTING POINT,DENSITY,YEAR OF DISCOVERY
2A 900 FOR I = 1 TO 6: READ MS$(I): NEXT
1B 910 RETURN
3E 920 REM ELEMENT DETAILS
EC 930 D$ = CHR$(4):FILE$ = "ELEMENTS"
05 940 PRINT D$;"OPEN" + FILE$
CF 950 PRINT D$;"READ" + FILE$
D9 960 FOR I = 1 TO N
9D 970 INPUT SYM$(I),NM$(I)
55 980 FOR J = 1 TO 5
8D 990 INPUT X(I,J)
6C 1000 NEXT J

```

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```
24 1010 INPUT CM$(I,1),CM$(I,2)
73 1020 NEXT I
1F 1030 PRINT D$;"CLOSE"
E1 1040 RETURN
6A 1050 REM MENU
50 1060 HOME
8F 1070 VTAB 6: HTAB 9: PRINT "WOULD YOU LIKE TO"
B9 1080 FOR I = 1 TO 4
15 1090 VTAB I * 2 + 7: HTAB 10: INVERSE : PRINT I;:
    NORMAL : PRINT CHR$ (32);MM$(I)
A3 1100 NEXT
D9 1110 VTAB 18: HTAB 10: PRINT "=> ? ";BELL$;
5E 1120 GET S$
62 1130 PICK = VAL (S$)
E4 1140 IF PICK < 1 OR PICK > 4 THEN 1110
E7 1150 RETURN
AD 1160 REM VIEW FAMILY
92 1170 : REM MAKE SELECTION
8D 1180 GOSUB 1270
4E 1190 IF V = 11 THEN 1260
67 1200 : REM DISPLAY
7F 1210 GOSUB 1380
83 1220 : REM GET RESPONSE
6F 1230 GOSUB 1730
F9 1240 : REM ELEMENT NAME
8E 1250 IF CHR$ (A) = "N" THEN GOSUB 1810: GOTO 1230
ED 1260 RETURN
35 1270 REM SELECTION
5C 1280 HOME
1A 1290 VTAB 3: HTAB 6: PRINT "WHICH FAMILY WOULD YO
    U LIKE"
F2 1300 FOR I = 1 TO K + 1
F5 1310 VTAB I + 5: HTAB 7: INVERSE : PRINT CHR$ (I
    + 64);: NORMAL : HTAB 9: PRINT FM$(I)
AF 1320 NEXT
ED 1330 VTAB 20: HTAB 7: PRINT "=> ? ";:CLICK = PEE
    K (Z)
6A 1340 GET S$
53 1350 A = ASC (S$): IF A > 96 THEN A = A - 32
59 1360 V = A - 64: IF V < 1 OR V > 11 THEN 1330
F3 1370 RETURN
AF 1380 REM DISPLAY
62 1390 HOME
83 1400 PRINT L$;
95 1410 S$ = FM$(V):L = LEN (S$)
9C 1420 INVERSE : HTAB (21 - L / 2): PRINT S$: NORMA
    L
8F 1430 PRINT L$;
C1 1440 RW = R(V):CL = C(V):E = 1
25 1450 IF RW = 1 THEN R = 10
```

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```
A2 1460 IF RW = 2 THEN R = 8:DR = 6
86 1470 IF RW = 3 THEN R = 6:DR = 5
9E 1480 FOR I = 1 TO RW
61 1490 IF CL = 3 THEN C = 11:DC = 8
2A 1500 IF CL = 5 THEN C = 5:DC = 7
0F 1510 IF CL = 6 THEN C = 4:DC = 6
B6 1520 FOR J = 1 TO CL
5C 1530 : REM DRAW BOX
6D 1540 GOSUB 1620
BD 1550 E = E + 1:C = C + DC
8E 1560 NEXT J
5B 1570 R = R + DR
95 1580 NEXT I
8B 1590 VTAB 20: HTAB 13: PRINT "<ATOMIC NUMBERS>"
56 1600 VTAB 21: HTAB 1: PRINT L$;
E1 1610 RETURN
AB 1620 REM BOX
6E 1630 ELEMENT = FE(V,E): IF EL = 0 THEN 1720
18 1640 INVERSE
19 1650 FOR L = 0 TO 2
69 1660 VTAB R + L: HTAB C: PRINT SPC( 4)
96 1670 NEXT L
B2 1680 VTAB R + 1: HTAB C + 1: PRINT SYM$(ELEMENT):
    NORMAL
E7 1690 N$ = STR$(ELEMENT): IF LEN (N$) = 1 THEN N$
    = "0" + N$
3D 1700 N$ = "<" + N$ + ">"
D5 1710 VTAB R - 1: HTAB C: PRINT N$
E7 1720 RETURN
0D 1730 REM RESPONE
86 1740 VTAB 22: HTAB 1: PRINT "PRESS:"
9F 1750 VTAB 24: HTAB 5: INVERSE : PRINT "N";: NORMA
    L : PRINT " " FOR ELEMENT NAME"; SPC( 4);: INV
    ERSE : PRINT "R";: NORMAL : PRINT " " TO RESUM
    E";
2A 1760 P = PEEK ( - 16384): IF P < 128 THEN 1760
F1 1770 POKE - 16368,0
45 1780 A = P - 128: IF A > 96 THEN A = A - 32
85 1790 IF A < > 78 AND A < > 82 THEN CLICK = PEEK (
    Z): GOTO 1760
E1 1800 RETURN
DE 1810 REM ELEMENT NAME
B6 1820 VTAB 22: HTAB 1: PRINT SPC( 6): VTAB 24: HTA
    B 5: PRINT SPC( 33);
B7 1830 : REM ENTER NUMBER
16 1840 VTAB 23: HTAB 29: PRINT SPC( 10):CLICK = PEE
    K (Z)
0C 1850 VTAB 23: HTAB 11: INPUT "ATOMIC NUMBER = ? "
    ;S$
86 1860 V = VAL (S$): IF V < 1 OR V > 103 THEN 1840
```

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```
8F 1870 : REM DISPLAY
41 1880 VTAB 23: HTAB 11: NORMAL : PRINT SPC( 21)
8B 1890 VTAB 22: HTAB 1: INVERSE : PRINT SYM$(V);: N
    ORMAL : PRINT " IS ";NM$(V);"."
76 1900 VTAB 24: HTAB 14: PRINT "PRESS ANY KEY ";
6A 1910 GET S$
49 1920 VTAB 22: HTAB 1: PRINT SPC( 39): VTAB 24: HT
    AB 14: PRINT SPC( 13)
EF 1930 RETURN
FB 1940 REM VIEW AN ELEMENT
80 1950 : REM METHOD OF SELECTION
87 1960 GOSUB 2060
5C 1970 : REM SELECT IT
9F 1980 GOSUB 2270
EF 1990 IF V = 0 THEN GOSUB 2480: GOTO 1960
1E 2000 : REM DISPLAY IT
6E 2010 GOSUB 2550
42 2020 NORMAL
6F 2030 VTAB 23: HTAB 14: PRINT "PRESS ANY KEY ";
65 2040 GET S$
E6 2050 RETURN
12 2060 REM METHOD
55 2070 HOME
E9 2080 M$(1) = "NUMBER":M$(2) = "SYMBOL":M$(3) = "N
    AME"
09 2090 VTAB 3: HTAB 9: PRINT "IDENTIFY ELEMENT BY I
    TS:"
8E 2100 FOR I = 2 TO 3
F0 2110 VTAB I * 2 + 4: HTAB 17: PRINT M$(I)
AC 2120 NEXT
C8 2130 VTAB 14: HTAB 9: PRINT "USE <SPACE BAR> TO M
    OVE;": VTAB 15: HTAB 10: PRINT "HIT <RETURN>
    TO SELECT"
6F 2140 M = 1
D8 2150 IF M = 4 THEN M = 1
D9 2160 IF M = 0 THEN M = 3
B5 2170 VTAB M * 2 + 4: HTAB 17: INVERSE : PRINT M$(
    M): NORMAL
78 2180 CLICK = PEEK (Z)
6B 2190 P = PEEK ( - 16384): IF P < 128 THEN 2190
CC 2200 POKE - 16368,0
D9 2210 A = P - 128: IF NOT (A = 32 OR A = 13 OR A =
    10 OR A = 11) THEN 2180
D5 2220 IF A < > 13 THEN VTAB M * 2 + 4: HTAB 17: PR
    INT M$(M)
3C 2230 IF A = 32 OR A = 10 THEN M = M + 1
5C 2240 IF A = 11 THEN M = M - 1
82 2250 IF A < > 13 THEN 2150
EE 2260 RETURN
10 2270 REM SELECT IT
```

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```
2A 2280 VTAB 19: HTAB 1: PRINT "PLEASE CHOOSE YOUR E
    LEMENT."
EB 2290 VTAB 21: HTAB 12: PRINT SPC( 25):CLICK = PEE
    K (Z)
87 2300 VTAB 21: HTAB 1: PRINT M$(M); TAB( 8);: INPU
    T "= ? ";S$
4F 2310 V = VAL (S$)
A7 2320 IF S$ = "" OR (M = 1 AND (V < 1 OR V > 103))
    THEN 2290
C9 2330 : REM CHECK LEGALITY
1D 2340 ON M - 1 GOSUB 2360,2420
EC 2350 RETURN
89 2360 REM SYMBOL
CF 2370 V = 0
62 2380 FOR I = 1 TO N
EB 2390 IF SYM$(I) = S$ THEN V = I:I = N
AA 2400 NEXT
DE 2410 RETURN
A1 2420 REM NAME
C1 2430 V = 0
54 2440 FOR I = 1 TO N
27 2450 IF NM$(I) = S$ THEN V = I:I = N
C2 2460 NEXT
F6 2470 RETURN
0F 2480 REM ERROR
65 2490 HOME
63 2500 VTAB 10: HTAB 17: INVERSE : PRINT "SORRY:":
    NORMAL
F4 2510 VTAB 12: HTAB 1: PRINT S$;" DOESN'T EXIST !"
80 2520 VTAB 19: HTAB 14: PRINT "PRESS ANY KEY ";
6B 2530 GET S$
EC 2540 RETURN
A8 2550 REM DISPLAY
46 2560 : REM TOP ITEMS
84 2570 GOSUB 2630
A0 2580 : REM DRAW CARD
90 2590 GOSUB 2730
E2 2600 : REM CARD ITEMS
5E 2610 GOSUB 2800
E6 2620 RETURN
82 2630 REM TOP ITEMS
6E 2640 U$(1) = "CELSIUS":U$(2) = U$(1):U$(3) = "GRA
    MS/MILLILITER"
59 2650 HOME
AE 2660 FOR I = 1 TO 3
9A 2670 VTAB I: HTAB 1: PRINT MS$(I + 2);
A8 2680 PRINT TAB( 14)": ";
31 2690 IF X(V,I + 1) < > 9999 THEN PRINT X(V,I + 1)
    ; TAB( 23);U$(I)
0D 2700 IF X(V,I + 1) = 9999 THEN PRINT "UNKNOWN"
```

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```

B4 2710 NEXT
E8 2720 RETURN
2C 2730 REM CARD
1B 2740 INVERSE
D1 2750 FOR I = 8 TO 19
7E 2760 VTAB I: HTAB 4: PRINT SPC( 32)
CC 2770 NEXT
09 2780 VTAB 7: HTAB 4: PRINT SPC( 6)
05 2790 RETURN
E0 2800 REM ITEMS
D2 2810 : REM NUMBER & NAME
06 2820 VTAB 7: HTAB 5: PRINT "<";V;">: NORMAL
52 2830 T$ = NM$(V) + CHR$( 32) + "<" + SYM$(V) + ">
"
69 2840 VTAB 7: HTAB 23 - LEN (T$) / 2: PRINT T$
3D 2850 : REM COMMENTS
F8 2860 RW = 9
A6 2870 FOR I = 1 TO 2
BA 2880 PH$ = CM$(V,I): GOSUB 2950
A0 2890 NEXT I
4C 2900 : REM YEAR DISCOVERED
5B 2910 IF X(V,5) < > 9999 THEN PH$ = "DISCOVERED IN
" + STR$(X(V,5)): GOSUB 2950
C4 2920 : REM WEIGHT
E4 2930 IF X(V,1) < > 9999 AND V < > 6 THEN GOSUB 30
90
F4 2940 RETURN
AF 2950 REM WRITE
27 2960 INVERSE
4B 2970 L = LEN (PH$):P1$ = PH$:P2$ = ""
3A 2980 IF L > 28 THEN GOSUB 3030
43 2990 VTAB RW: HTAB 5: PRINT "~ " + P1$
5D 3000 IF P2$ < > "" THEN VTAB RW + 1: HTAB 7: PRIN
T P2$:RW = RW + 1
5C 3010 RW = RW + 2
D8 3020 RETURN
7F 3030 REM DIVIDE LINE
B7 3040 FOR J = L TO 1 STEP - 1
C0 3050 LT$ = MID$(PH$,J,1)
9B 3060 IF LT$ = CHR$( 32) AND J < = 28 THEN P2$ = R
IGHT$(PH$,L - J):P1$ = LEFT$(PH$,J - 1):J
= 1
8A 3070 NEXT J
F3 3080 RETURN
D2 3090 REM WEIGHT
CD 3100 DL = X(V,1) - 12
10 3110 PD = DL * 100 / 12
F3 3120 PD = INT (PD * 10 + .5) / 10
B7 3130 PH$ = "1 <" + SYM$(V) + "> ATOM WEIGHS " + S
TR$( ABS (PD)) + "% "

```


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```
F3 3140 S$ = "LESS": IF PD > 0 THEN S$ = "MORE"
08 3150 PH$ = PH$ + S$ + " THAN 1 CARBON ATOM"
95 3160 GOSUB 2950
F1 3170 RETURN
08 3180 REM SORT
44 3190 : REM CHOOSE SORT
60 3200 GOSUB 3260
29 3210 : REM SORT
81 3220 GOSUB 3370
75 3230 : REM DISPLAY
95 3240 GOSUB 3480
EB 3250 RETURN
57 3260 REM CHOOSE
5A 3270 HOME
C1 3280 VTAB 4: HTAB 10: PRINT "VARIABLE TO SORT BY:
"
E3 3290 FOR I = 1 TO 6
11 3300 VTAB I * 2 + 5: HTAB 11: INVERSE : PRINT I,:
    NORMAL : PRINT CHR$ (32);MS$(I)
AD 3310 NEXT
7C 3320 VTAB 19: HTAB 11: PRINT "==> ? ";
1D 3330 CLICK = PEEK (Z): GET S$
5C 3340 V = VAL (S$)
C1 3350 IF V < 1 OR V > 6 THEN 3320
F1 3360 RETURN
08 3370 REM SORT
60 3380 HOME
DA 3390 VTAB 12: HTAB 16: PRINT "SORTING"
78 3400 Q = V - 1
C1 3410 FOR I = 1 TO N: X(I,0) = I: SV(I) = X(I,Q): NE
    XT
C9 3420 SWAP$ = "N"
73 3430 FOR I = 1 TO N - 1
B0 3440 IF SV(I) > SV(I + 1) THEN H1 = SV(I): SV(I) =
    SV(I + 1): SV(I + 1) = H1: H2 = X(I,0): X(I,0)
    = X(I + 1,0): X(I + 1,0) = H2: SWAP$ = "Y"
BF 3450 NEXT
2B 3460 IF SWAP$ = "Y" THEN 3420
F7 3470 RETURN
B3 3480 REM DISPLAY
09 3490 DA = 3: REM DIGITS AFTER DECIMAL
69 3500 IF V = 3 OR V = 4 THEN DA = 1
08 3510 IF V = 1 OR V = 6 THEN DA = 0
D8 3520 FOR I = 1 TO N STEP 10
BB 3530 : REM HEADING
A7 3540 GOSUB 3590
1E 3550 : REM BODY
B3 3560 GOSUB 3690
93 3570 NEXT I
FD 3580 RETURN
```

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```

D9 3590 REM HEADING
A3 3600 T$ = "ELEMENTS BY " + MS$(V)
4A 3610 HOME
B3 3620 PRINT L$
71 3630 VTAB 2: HTAB 21 - LEN (T$) / 2: INVERSE : PR
    INT T$: NORMAL
BB 3640 PRINT L$
1E 3650 INVERSE
F2 3660 S$ = MS$(V): IF V = 6 THEN S$ = "CALENDAR YE
    AR"
3E 3670 VTAB 5: HTAB 3: PRINT "SYMBOL";: HTAB 17: PR
    INT "NAME";: HTAB 37 - LEN (S$): PRINT S$: N
    ORMAL
FF 3680 RETURN
09 3690 REM BODY
20 3700 ROW = 8
93 3710 FOR J = I TO I + 9
61 3720 IF J > N THEN 3840
4A 3730 E = X(J,0)
45 3740 : REM SYMBOL
BB 3750 S$ = SYM$(E): VTAB ROW: HTAB 6 - LEN (S$): P
    RINT S$
99 3760 : REM NAME
16 3770 S$ = NM$(E): VTAB ROW: HTAB 21 - LEN (S$): P
    RINT S$
82 3780 : REM VALUE
A7 3790 NR = SV(J): IF NR = 9999 THEN VTAB ROW: HTAB
    26: PRINT "UNKNOWN": GOTO 3830
7F 3800 VTAB ROW: HT = 32: GOSUB 9000
D0 3810 IF V = 3 OR V = 4 THEN VTAB ROW: HTAB 34: PR
    INT "C"
17 3820 IF V = 5 THEN VTAB ROW: HTAB 34: PRINT "G/ML
    ";
BF 3830 ROW = ROW + 1
8E 3840 NEXT J
C3 3850 VTAB 19: HTAB 1: PRINT L$
C3 3860 VTAB 21: HTAB 14: PRINT "PRESS ANY KEY ";: G
    ET S$
FF 3870 RETURN
57 9000 REM "PRINT USING" SUBROUTINE
00 9010 ZR$ = "": ZS$ = "": ZD$ = "": ZZ$ = "0000000000"
4A 9020 N$ = STR$ (NR)
B9 9030 IF DOLL$ = "YES" THEN ZD$ = "$"
D6 9040 IF NR < 0 THEN ZS$ = "-"
4A 9050 LET ZN = ABS (NR) + 5 * 10 ^ - (DA + 1)
2F 9060 LET ZL = INT (ZN): ZR = INT ((ZN - ZL) * 10 ^
    DA)
AC 9070 IF DA > 0 THEN ZR$ = "." + RIGHT$ (ZZ$ + STR
    $ (ZR), DA)
49 9080 ZT$ = "    " + STR$ (ZL)

```

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```
72 9090 IF MID$ (ZT$, LEN (ZT$) - 3,1) < > "E" THEN
      N$ = ZS$ + ZD$ + STR$ (ZL) + ZR$
61 9100 HTAB (HT + 1 - LEN (N$)): PRINT N$
DF 9110 RETURN
```

Appendices

A ProDOS Automatic Menu

This program requires the ProDOS operating system.

Keeping track of what Applesoft programs are on which disks can be difficult. The little gum labels that come with disks seldom have quite enough room. Besides that, the contents of a disk change as new programs are saved and deleted. Clearly, this kind of mundane record keeping is a job for your computer.

"Menu" is a program that will give you a list of all Applesoft programs on a disk. It does this automatically so you never have to prepare any data for Menu to use. Not surprisingly, Menu presents the list of programs in the form of a menu. It lists the program names alphabetically and numerically. Just type in the number of the program that you want and Menu will run it for you.

Using Menu

Operating Menu requires just a few simple steps. Load the Menu program into memory; then insert the program disk that you want to use and run Menu.

Menu will ask you to type in a directory name. You can press Return to examine the volume directory. Or you can type in the complete ProDOS path name of a subdirectory. Type STOP when you are finished with this disk. You will have an opportunity to insert another disk and look at the programs stored there.

Menu will read the contents of the indicated directory or subdirectory and will save the names of all Applesoft programs as well as any subdirectory names. Menu then sorts the list of names alphabetically. Subdirectories are identified by a slash (/) after their names. The names are displayed 12 at a time, and you may press one of four keys:

F (forward) displays the next set of 12 names.

B (backward) displays the previous set of 12 names.

R (RUN) executes a program. Type in the number of the program that you want to run. If you press R by mistake and

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don't really want to run a program, press Return when you're asked for the program number. You cannot run a subdirectory, and Menu will warn you if you try.

Q (quit) exits the display mode and asks you to specify another directory name.

If you're not used to subdirectories, they may be a little confusing. Every disk has a volume directory, which may contain up to 51 entries. An entry may be the name of an Applesoft program, a machine language program, a data file, or subdirectory. Subdirectories themselves contain entries and the entries can be of any type including other subdirectories. Needless to say, the ProDOS catalog structure can become quite involved.

An example will illustrate how you can specify a subdirectory name when Menu asks for a directory name (see the second paragraph of this section). Suppose you have a disk labeled VOL1000. (Labels are assigned when you format a disk.) When Menu first starts, it will read the volume label automatically and tell you that VOL1000 is in the disk drive. Thus, you don't have to type in VOL1000—at least not yet. Menu will then list all the Applesoft programs and subdirectories present in VOL1000's volume directory.

For example, you could have a subdirectory called PROGRAMS. (Subdirectories can be created from Applesoft or with the ProDOS utilities disk.) To see what is in the subdirectory, you must go back to the point where Menu asks you to specify a directory or subdirectory name.

The complete ProDOS path name must be typed in. The path name begins with a slash, followed by the volume label and a series of one or more subdirectory names separated by slashes. Generally speaking, you will not have multiple levels of subdirectories on a disk. So, the path name reduces to a slash, the volume label, a slash, and the name of the desired subdirectory. To see the contents of the subdirectory PROGRAMS, you should type either

/VOL1000/PROGRAMS/ or **/VOL1000/PROGRAMS**

Make sure that a slash is the first character and that a slash is between the volume label name and the subdirectory name. The trailing slash is optional. (Note: If you leave off the /VOL1000, Menu will treat /PROGRAMS as a volume label. In other words, it will look for a disk labeled /PROGRAMS.)

Nothing serious will happen if you make a typing mistake. Menu will let you know if it is unable to locate a subdirectory. You can then retype the subdirectory name.

Making a Startup Disk

You can make Menu run automatically whenever you boot ProDOS. Simply rename Menu to "Startup," and save Startup on your boot disk (the disk that contains ProDOS). Now, whenever you start your system, you will automatically see a list of the available Applesoft programs.

Using this idea, you can prepare a series of disks tailored to specific applications. Suppose, for example, that you would like all the "Note Taker" programs on one disk. Using your ProDOS utilities disk, format a blank disk and copy these programs to the disk:

```
ProDOS
BASIC.System
Startup (Menu)
Noter.Setup
Noter.Add
Noter.Change
Noter.Sort
Noter.Search
Noter.Expand
```

This disk will then have all the programs you need for Note Taker. When you boot the system from this disk, you'll see the menu listing the program names.

Running Menu from Other Programs

Menu can be set to run automatically when another program ends. When a program finishes, Applesoft is normally in control. If you want to run Menu again, you have to type

RUN MENU or **-MENU**

You might want to have the Menu program start up again automatically. This gives you a simple, but complete, menu-driven system.

Fortunately, this is easy to do. Pick an Applesoft program, like "Noter.Setup." Locate the END statement in the program. Replace the END statement with

PRINT CHR\$(9);"RUN MENU"

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Use the name of the menu program as stored on your disk. When Noter.Setup ends, it will start the Menu program.

Repeat this program modification for each Applesoft program. Don't forget to save copies of the modified programs. Now, you can switch from program to program directly from the Menu, which will save time and effort, leaving you free to deal with other concerns.

Program A-1. Menu

For mistake-proof entry, use the "Apple Automatic Proofreader" (Appendix B) to type in this program.

```
4F 100 REM APPLESOFT PROGRAM MENU (MENU)
84 110 REM
13 120 HOME :D$ = CHR$ (4): PRINT CHR$ (21)
85 130 MP = 500
E0 140 DIM ID$(MP),PG$(MP): REM SAVE PROGRAM NAMES
8C 150 REM
8E 160 REM
0B 170 HOME : VTAB 1: HTAB 10: PRINT "APPLESOFT PROG
    RAM MENU"
10 180 GOSUB 330: REM GET DIRECTORY NAME
51 190 IF Q$ = "Y" THEN 300
81 200 GOSUB 490: REM OPEN PROGRAMS DIRECTORY
C7 210 IF E$ = "Y" THEN 180
9B 220 GOSUB 620: REM SAVE PROGRAMS
1E 230 GOSUB 910: REM DISPLAY MENU
4D 240 HOME
66 250 VTAB 12: HTAB 1: PRINT "DO YOU WANT THE MENU
    AGAIN (Y/N)? ";
3D 260 GET R$: IF R$ = "" THEN 260
A3 270 IF R$ = "Y" OR R$ = "y" THEN 170
73 280 IF R$ = "N" OR R$ = "n" THEN 300
23 290 GOTO 250
04 300 HOME : VTAB 12: HTAB 1: PRINT "THANK YOU"
C1 310 PRINT : PRINT : PRINT
8F 320 END
D2 330 REM GET DIRECTORY NAME
8C 340 REM
8A 350 PRINT D$;"PREFIX /"
43 360 PRINT D$;"PREFIX "
1E 370 INPUT VL$
01 380 PRINT D$
2D 390 Q$ = "N"
85 400 VTAB 4: HTAB 1: PRINT "TYPE IN A DIRECTORY NA
    ME OR
1D 410 VTAB 6: HTAB 1: PRINT "PRESS RETURN FOR THE V
    OLUME DIRECTORY."
```

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```

5F 420 VTAB 22: HTAB 1: PRINT "TYPE 'STOP' WHEN YOU
    ARE FINISHED."
E2 430 VTAB 10: HTAB 1: PRINT SPC( 20)
60 440 TM$ = VL$:RW = 8:CL = 1:SZ = 39: GOSUB 1500:
    REM LINE INPUT
3B 450 IF TM$ < > "" THEN VL$ = TM$
A9 460 IF VL$ = "STOP" OR VL$ = "stop" THEN Q$ = "Y"
EF 470 IF RIGHT$(VL$,1) < > "/" THEN VL$ = VL$ + "/"
    "
24 480 RETURN
B1 490 REM OPEN PROGRAMS DIRECTORY
86 500 REM
BE 510 E$ = "N"
87 520 ONERR GOTO 560
CF 530 PRINT D$;"OPEN ";VL$;"",TDIR"
EA 540 POKE 216,0: REM NORMAL ERR
1F 550 RETURN
EE 560 POKE 216,0: REM NORMAL ERR
9E 570 CALL - 3288: REM FIX STACK
D6 580 VTAB 10: HTAB 1: PRINT "THE DIRECTORY IS NOT
    ON THE DISKETTE."
54 590 E$ = "Y"
FB 600 FOR I = 1 TO 2000: NEXT
18 610 RETURN
9E 620 REM SAVE PROGRAMS
8D 630 REM
6C 640 VTAB 12: HTAB 1: PRINT "WORKING ..."
18 650 FOR I = 1 TO MP:ID$(I) = "":PG$(I) = "": NEXT
D6 660 VTAB 12: HTAB 1: PRINT "READING THE DIRECTORY
    ..."
E4 670 PRINT D$;"READ ";VL$
02 680 INPUT L1$: REM DIRECTORY
55 690 INPUT L2$: REM TITLE
52 700 INPUT L3$: REM BLANK
2E 710 K = 0
92 720 INPUT L4$: IF L4$ = "" THEN 800
9C 730 TP$ = MID$( L4$,18,3)
A7 740 IF TP$ < > "BAS" AND TP$ < > "DIR" THEN 720
DF 750 K = K + 1: IF K > MP THEN 800
74 760 ID$(K) = RIGHT$( " " + STR$(K),3)
37 770 PG$(K) = MID$( L4$,2,15)
C7 780 IF TP$ = "DIR" THEN PG$(K) = PG$(K) + "/"
A7 790 GOTO 720
8B 800 PRINT D$;"CLOSE"
9E 810 VTAB 12: HTAB 1: PRINT "SORTING PROGRAM NAMES
    ..."
9B 820 IF K < = 2 THEN 890
73 830 S = 0
CD 840 FOR I = 1 TO K - 1
6A 850 IF PG$(I) < = PG$(I + 1) THEN 870

```

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```
EA 860 T$ = PG$(I):PG$(I) = PG$(I + 1):PG$(I + 1) =  
    T$:S = 1  
0E 870 NEXT  
A5 880 IF S < > 0 THEN 830  
F8 890 VTAB 12: HTAB 1: PRINT SPC( 40)  
19 900 RETURN  
5F 910 REM DISPLAY MENU  
8E 920 REM  
F5 930 GOSUB 1320: REM PAINT MENU SCREEN  
1A 940 P = 1: REM PROGRAM ARRAY POINTER  
CB 950 PS = P: REM PAGE START  
A2 960 FOR R = 5 TO 16  
2C 970 VTAB R: HTAB 11: PRINT SPC( 20)  
42 980 IF P > K THEN 1010  
87 990 VTAB R: HTAB 11: PRINT ID$(P); " ";PG$(P)  
DB 1000 P = P + 1  
A5 1010 NEXT  
46 1020 VTAB 20: HTAB 33  
AC 1030 GET R$: IF R$ = "" THEN 1030  
81 1040 PRINT  
82 1050 IF R$ = "F" OR R$ = "f" THEN GOSUB 1110: GOT  
    O 950  
68 1060 IF R$ = "B" OR R$ = "b" THEN GOSUB 1150: GOT  
    O 950  
AA 1070 IF R$ = "R" OR R$ = "r" THEN GOSUB 1200: GOT  
    O 950  
32 1080 IF R$ = "Q" OR R$ = "q" THEN 1100  
76 1090 GOTO 1020  
D3 1100 RETURN  
4C 1110 REM PAGE FORWARD  
BE 1120 REM  
1B 1130 P = PS + 12: IF P > K THEN P = 1  
E3 1140 RETURN  
9F 1150 REM PAGE BACKWARD  
CE 1160 REM  
38 1170 P = PS - 12  
40 1180 IF P < 1 THEN P = K - 11: IF P < 1 THEN P =  
    1  
F7 1190 RETURN  
03 1200 REM RUN A PROGRAM  
BC 1210 REM  
CB 1220 TM$ = "":RW = 20:CL = 33:SZ = 3: GOSUB 1500:  
    REM LINE INPUT  
61 1230 IF TM$ = "" THEN 1310  
18 1240 NP = VAL (TM$): IF NP < 1 OR NP > K THEN 122  
    0  
56 1250 IF RIGHT$ (PG$(NP),1) < > "/" THEN 1300  
1D 1260 VTAB 22: HTAB 1: PRINT "CAN'T RUN A SUB-DIRE  
    CTORY"
```


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```

C7 1270 FOR I = 1 TO 3000: NEXT
94 1280 VTAB 22: HTAB 1: PRINT SPC( 40)
7E 1290 GOTO 1220
DA 1300 PRINT D$; "RUN "; VL$; PG$(NP)
DB 1310 RETURN
A1 1320 REM PAINT MENU SCREEN
C6 1330 REM
BF 1340 HOME : VTAB 1: HTAB 10: PRINT "APPLESOFT PRO
    GRAM MENU"
16 1350 INVERSE
D7 1360 VTAB 3: HTAB 6: PRINT SPC( 30)
1C 1370 VTAB 18: HTAB 6: PRINT SPC( 30)
1C 1380 FOR R = 4 TO 17: VTAB R: HTAB 6: PRINT " ":
    NEXT
DC 1390 FOR R = 4 TO 17: VTAB R: HTAB 35: PRINT " ":
    NEXT
41 1400 NORMAL
37 1410 VTAB 20: HTAB 1: PRINT "BACK    FORWARD    Q
    UIT      RUN"
0C 1420 INVERSE
C7 1430 VTAB 20: HTAB 1: PRINT "B"
D1 1440 VTAB 20: HTAB 9: PRINT "F"
3A 1450 VTAB 20: HTAB 20: PRINT "Q"
47 1460 VTAB 20: HTAB 28: PRINT "R"
F1 1470 VTAB 23: HTAB 1: PRINT VL$
61 1480 NORMAL
FD 1490 RETURN
4E 1500 REM -- LINE INPUT WITH TEMPLATE DRIVER
A2 1510 GOSUB 1560: REM LINE INPUT
32 1520 VTAB RW: HTAB CL: PRINT SPC( SZ); CHR$(13);
B9 1530 IF R$ < > "" THEN TM$ = R$
49 1540 VTAB RW: HTAB CL: PRINT LEFT$(TM$,SZ); CHR$(
    13);
EF 1550 RETURN
F8 1560 REM -- LINE INPUT SUBROUTINE
79 1570 LET ZT$ = TM$:R$ = "":ZP = 0
86 1580 FOR ZI = 1 TO SZ:ZT$ = ZT$ + " ": NEXT :ZT$
    = LEFT$( ZT$,SZ)
61 1590 VTAB 1: HTAB 1: PRINT : VTAB RW: HTAB CL: IN
    VERSE : PRINT ZT$;
F2 1600 VTAB 1: HTAB 1: PRINT : VTAB RW: HTAB CL
50 1610 GET ZC$
CC 1620 IF ZC$ = CHR$(3) THEN STOP : REM CTRL-C
51 1630 IF ZC$ = CHR$(24) THEN 1570: REM CTRL-X
6E 1640 IF ZC$ = CHR$(8) THEN 1700: REM LEFT ARROW
EB 1650 IF ZC$ = CHR$(13) THEN 1750: REM CR
5F 1660 IF ZC$ < CHR$(32) OR ZC$ > CHR$(127) THEN
    1610
21 1670 IF ZP < SZ THEN HTAB CL + ZP: PRINT ZC$;:R$
    = R$ + ZC$

```


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```
1B 1680 LET ZP = ZP + 1: IF ZP > = SZ THEN 1750
8A 1690 GOTO 1610
DB 1700 HTAB CL + ZP: PRINT " "; ZP = ZP - 1: IF ZP
    < 0 THEN ZP = 0: REM BACKSPACE
1E 1710 VTAB 1: HTAB 1: PRINT : VTAB RW: HTAB CL + Z
    P
21 1720 IF LEN (R$) < = 1 THEN R$ = ""
BE 1730 IF LEN (R$) > 1 THEN R$ = LEFT$ (R$, LEN (R$
    ) - 1)
7B 1740 GOTO 1610
4D 1750 NORMAL : REM CR
9F 1760 PRINT CHR$ (13);
FB 1770 RETURN
```

B Apple Automatic Proofreader

Tim Victor

“Apple Automatic Proofreader” will help you type in program listings without typing mistakes. It’s a short error-checking program that hides itself in memory and attaches to your Apple’s operating system. Each time you press Return to enter a program line, this routine displays a two-digit checksum at the top of your screen. If you’ve typed the line correctly, the checksum on your screen matches the one in the printed listing—it’s that simple. You don’t have to use the Proofreader to enter listings, but doing so greatly reduces your chance of making an error.

Getting Started

First, type in the Apple Automatic Proofreader program following this article. The Proofreader can’t check itself before it’s done, so you’ll have to be extra careful to avoid mistakes.

The Proofreader checks which operating system you’re running before it hooks up the checksum routine; you can type it in with either DOS 3.3 or ProDOS. If you want to use the Proofreader with both operating systems, you won’t have to retype it. All you need is a utility to copy a file between disks with different formats, such as the one provided on the ProDOS *User’s* or *System Utilities* disk.

As soon as you finish typing the Proofreader, save at least two copies before running it the first time. This is very important, because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Now, type RUN and hit Return. The Proofreader clears the screen, loads the machine language routine, displays the message PROOFREADER ACTIVATED, erases the BASIC portion of itself, and ends. If you type LIST and press Return, you’ll see that no BASIC program is in memory. The computer is ready for you to type in a new BASIC program.

Entering Programs

Once the Proofreader is activated, you can begin typing in a BASIC program as usual. Each time you finish typing a line and press Return, the Proofreader displays a two-digit checksum number in the upper-left corner of the screen. Compare this checksum with the two-digit checksum printed next to the corresponding line in the program listing. If the numbers match, you can be pretty certain the line was typed correctly. Otherwise, check for your mistake and type the line again.

A common mistake when entering BASIC programs on the Apple occurs when you accidentally press a key while holding down the Control key. This adds an invisible control character to the line you are typing. If you don't find it before you run the program, this stray character may cause a SYNTAX ERROR or other mysterious behavior. Fortunately, the Proofreader detects the presence of these invisible control characters and displays a checksum that doesn't match the one in the listing. So it's always a good idea to retype a line if the checksums don't match, even though you might not see any difference in the lines themselves.

The Proofreader ignores space characters, so you can omit spaces between keywords and still see a matching checksum. Spaces are important only between the quotation marks of PRINT statements or string assignments. The only mistake the Proofreader won't catch is if you accidentally type too many spaces or leave some out. For this reason, be extra careful when you're entering text within quotes.

Before running another BASIC program, it's a good idea to turn off the Proofreader by holding down the Control key and pressing the Reset button. The machine language part of the Proofreader is kept in memory starting at address 768 (\$300 hexadecimal). This location is out of BASIC's way, but a lot of other programs use this same place for their machine language subroutines. Disable the Proofreader to avoid conflicts.

How Proofreader Works

When the Applesoft BASIC interpreter needs to get a line of input from the keyboard, it calls a machine language routine in the Apple's read only memory (ROM) called GETLN. GETLN, in turn, calls the operating system to get a single

keypress, which it stores in an input buffer. If the Return key is pressed, GETLN ends, leaving one new line for the BASIC interpreter in the input buffer. Otherwise, it repeats the process, asking for another keypress.

The operating system normally gets individual keystrokes from a ROM routine called KEYIN, but the Proofreader changes this. When the Proofreader is installed, the operating system calls the checksum routine instead, and the checksum routine asks KEYIN for a character. If any key other than Return is pressed, the checksum routine just passes it on to the operating system, which gives it to GETLN. But if Return is pressed, the checksum routine examines the contents of GETLN's input buffer, which now contains an entire line of input, to calculate the checksum that it displays at the top of the screen.

A common typing mistake is transposition—typing two successive characters in the wrong order, like *PIRNT* instead of *PRINT*. A checksum program that merely adds the codes of the characters in a line can detect only the presence or absence of a character, not transposition errors. Because the Apple Proofreader uses a sophisticated formula to compute checksums, it alerts you to transposed keystrokes.

The Automatic Proofreader detects almost every possible typing mistake, including transpositions, missing or extra characters, accidental control characters, and incorrect line numbers. Typing *Apple II Applications* programs into your Apple computer couldn't be easier.

Program A-2. Apple Automatic Proofreader

```
52 10 C = 0: FOR I = 768 TO 768 + 68: READ A: C = C +  
    A: POKE I, A: NEXT  
80 20 IF C < > 7258 THEN PRINT "ERROR IN PROOFREADER  
    DATA STATEMENTS": END  
00 30 IF PEEK (190 * 256) < > 76 THEN POKE 56, 0: POK  
    E 57, 3: CALL 1002: GOTO 50  
70 40 PRINT CHR$ (4); "IN#A$300"  
24 50 POKE 34, 0: HOME : POKE 34, 1: VTAB 2: PRINT "PR  
    OOFREADER INSTALLED"  
FE 60 NEW  
52 100 DATA 216, 32, 27, 253, 201, 141  
10 110 DATA 208, 60, 138, 72, 169, 0  
75 120 DATA 72, 189, 255, 1, 201, 160  
FA 130 DATA 240, 8, 104, 10, 125, 255  
47 140 DATA 1, 105, 0, 72, 202, 208
```

APPENDIX B

1B 150 DATA 238, 104, 170, 41, 15, 9
AF 160 DATA 48, 201, 58, 144, 2, 233
DB 170 DATA 57, 141, 1, 4, 138, 74
9E 180 DATA 74, 74, 74, 41, 15, 9
B5 190 DATA 48, 201, 58, 144, 2, 233
E3 200 DATA 57, 141, 0, 4, 104, 170
A9 210 DATA 169, 141, 96

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